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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN, THE NATIONAL IRONFOUNDING EMPLOYERS' FEDERATION, THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

OCTOBER 20.

Iron and Steel Institute (West of Scotland Branch):—Meeting at Glasgow, at 7.15. Presidential address by A. McCance, D.Sc.

OCTOBER 24.

Institution of Engineers and Shipbuilders in Scotland:—Meeting in Glasgow, at 7.30 p.m. "Flame-Cutting of Steel for Welded Joints," Paper by E. J. Clarke.

OCTOBER 27.

Manchester Association of Engineers:—"The Selection of Steels for Engineering Requirements," Paper by F. W. Rowe, B.Sc.

Institute of British Foundrymen.

OCTOBER 20.

Sheffield and District Branch:—"Stainless and Heat-Resisting Castings," Paper by J. F. Kayser.

OCTOBER 21.

Wales and Monmouth Branch:—Meeting at Cardiff. "Some Practical Considerations in a Small Jobbing Foundry," Paper by B. Gale.
Scottish Branch (Falkirk Section):—"Prague," Paper by J. M. Primrose.
East Midlands Branch (Lincolnshire Section):—"Mechanised Foundries," Paper by F. J. Cook.

OCTOBER 26.

Birmingham, Coventry and West Midlands Branch:—Open discussion: "The Production of Sound Cast-Iron Castings." Joint meeting with the Midland Metallurgical Societies.

OCTOBER 27.

Middlesbrough Branch:—"Contraction, Distortion and Camber in Grey-Iron Castings," Paper by E. Longden.

OCTOBER 28.

Lancashire Branch (Junior Section):—President's address, followed by lecture, "The Manufacture of Iron Castings for Enamelling and Galvanising," by F. Griffiths.
East Midlands Branch:—Meeting at Derby. "Technical Control in the Small Foundry," Paper by J. G. Pearce.
Scottish Branch (Edinburgh Section):—"Grey-Iron Castings for Laundry Machinery," Paper by J. Longden.
Newcastle-upon-Tyne and District Branch:—Presidential address by J. D. Carmichael, O.B.E., followed by "The Building of the Sydney Harbour Bridge" (Film).

Mechanisation and Effort.

Mr. Lewis, in his Presidential Address to the Birmingham Branch of the Institute of British Foundrymen, gave the impression that more strenuous conditions existed in mechanised foundries than in those operating under old-fashioned conditions. This generalisation must be accepted with considerable reserve, and we propound the reverse as being nearer the truth, whilst admitting that excessive energy can be exerted by operators in continuous plants. The hardest-worked moulders we have ever seen were Belgians working in French foundries just over the frontier, and dago labour in the Parisian mechanised motor-car foundries, employed on the moulding machines. The former had to bend and walk, whilst the latter had merely lifting and lever pulling to perform—though excessively.

There is a factor in mechanised foundries which is insufficiently appreciated, and that is the rhythmic character of the work, which is less fatiguing than work of a jerky character. Moreover, the work being of an ordered type, any demands on labour of too strenuous a character can be noticed and easily remedied. For instance, the carrying of molten metal can be aided by a monorail; the lifting of any heavy boxes can be lightened by the use of an air hoist; the knocking out can be done *inter alia* by jarring. Shovelling and ramming are both onerous tasks, and these are usually entirely eliminated. There is obviously a continuous concentration of effort of a lighter, but quicker, character, and the synchronous movement of perhaps a dozen belts and two or three elevator lines communicates an erroneous impression of excessive speed and onerous conditions.

Some of the men on continuous plants have quite a "soft job," such as those whose job it is to see that the hoppers are working freely or the man who in some cases controls the moisture content of the sand, whilst the man in charge of the sand mill has a much easier time than his mate in a jobbing shop. The knock out is the only place where there is a concentration of heat and dust in the producing operations such as is not encountered in an ordinary foundry, but with the application of modern systems of handling and ventilation, no real discomfort need prevail. The main points which we wish to underline are that over-strenuous work or hot dusty conditions are merely incidental to individual plants, and should not be tolerated for any length of time in a well-organised continuous casting plant.

Are Conferences too Conventional?

Those who have recently expressed their perturbation at the perfunctory way many Papers appear to be received at the London meetings of the metallurgical institutions, and the casual nature of the discussions thereon, would have been a little surprised at the vitality displayed at the Cast Iron Research Association's study course recently held at Birmingham, referred to in our last issue. To begin with, a figure approaching one-half of the ordinary full membership of the Association were represented by no less than some one hundred and seventy representatives. There was nothing in the way of distraction to relieve the hard work of seven hours a day for nearly three days, in the form of lectures and demonstrations, and yet the course was endured without any of the absenteeism and the coming and going which is in the minds of those metallurgists referred to above as disturbing to many meetings.

Can it be that the average technical gathering does not offer sufficient hard work for those who attend? Can it be that delegates have too much offered to them in the form of social distraction and entertainment? Can it be that the conventions which have grown up during the past thirty years round the presentation of scientific Papers and discussions tend to strangle the interest of the average listener? We are aware that many people are apt to excuse their apparent lack of interest by suggesting that the important business at such gatherings is not done while Papers are being read or discussed, but this does not dispose of the weakness evidenced. At any rate, the B.C.I.R.A. is to be congratulated on the success of its effort, and in demonstrating in a practical way that the industry welcomes the opportunity of putting itself in touch with the latest developments and is not afraid of expending mental effort in the process. It is welcome evidence of the way the British foundry industry is living up to the responsibilities imposed by those developments. There is every cause for optimism as to the progress of the industry under such circumstances.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Visiting Cards.

To the Editor of The Foundry Trade Journal.

Sir,—As one who has travelled in the foundry trade for nearly 30 years, the correspondence on visiting cards published in your columns greatly interests me.

My experience has been that one gets along equally well without a card as with one, and as for a buyer caring two hoots as to whether his visitor is a "district manager" or only a "mere traveller" it is ridiculous. One thing Mr. Lockwood's letter does prove conclusively, and that is snobbishness does exist to-day, and it is apparently not confined to buyers of castings.—Yours, etc.,

T. H. Gray.

119, High Holborn,
London, W.C.1.
October 13, 1933.

To the Editor of The Foundry Trade Journal.

Sir,—I have been interested in reading the articles in your Journal on the subject of visiting cards, and especially the letter in the last issue written by Mr. Lockwood.

I quite agree with what Mr. Lockwood says regarding the front of the card. The psychological effect of a visiting card is great, and, apart from this, a card presented in anything but good taste and the best workmanship is an insult to the firm visited and the buyer representing it.—Yours, etc.,

Jno. C. Green.

151-154, Palace Chambers,
Westminster, S.W.1.
October 16, 1933.

Notes from I.B.F. Branches.

The opening meeting of the 1933-34 session of the Burnley Section of the Institute of British Foundrymen was held at the Burnley Municipal College on October 10, 1933. The President, Mr. J. Taylor, of Accrington, was in the chair, and the President of the Lancashire Branch, Mr. A. Phillips, and visitors from Sheffield, Manchester and Bury were present.

Mr. F. Whitehouse, of Sheffield, read a Paper on "Foundry Essentials and Incidentals," which was illustrated by lantern slides. Mr. Whitehouse took as examples a braking pin, 5 in. long and 1⅛-in. dia; rollers 2 in. long, 2-in. dia., carrying a ⅜-in. hole; a method of making six small pulleys at the cost of one. Also he illustrated a method of making furnace hearth plates with tubes cast in them, and methods of making pipes and valve boxes in green sand with green-sand cores. The weight of the castings varied from 1 to 5 cwts. The essentials of such jobs were special sectional core irons held together by long screws, which enabled the casting to be easily fettled, whilst the same core iron could be used repeatedly. He urged that many castings made to-day with dry-sand or loam cores could be made equally well with green-sand cores.

Mr. A. Jackson proposed a vote of thanks, which Mr. J. Hogg seconded. Mr. F. Whitehouse replied. After an excellent discussion, Mr. J. Taylor declared the meeting closed.

London Branch.—By virtue of the election of Mr. V. Delport to membership of the Institute's General Council, at the last annual convention of the Institute, his office of Branch delegate to the Council became vacant. Mr. Turner has been elected a Branch delegate to fill the vacancy.

Major F. A. Freeth.

PRESIDENT-ELECT OF THE BRITISH CAST IRON RESEARCH ASSOCIATION.

Dr. Francis Arthur Freeth, O.B.E., D.Sc., Ph.D., F.R.S., was born at Birkenhead on January 2, 1884.

Chief Chemist of Imperial Chemical Industries, Limited, Dr. Freeth—or, as he prefers to be called, Major Freeth—is well known both as a scientist and lecturer, and is one of the few men attaining the distinction of F.R.S. who have spent the whole of their life in industry. He obtained the degree of Doctor of Science at Liverpool University in 1924, and of Doctor in the Faculty of Mathematics and Physics at the University of Leyden in the same year. He became Fellow of the Institute of Chemistry in 1919 and of the Institute of Physics in 1920.

Major F. A. Freeth, F.R.S.

He is also Vice-President of the Chemical Society and a member of the Institute of Fuel Technology.

Major Freeth's most striking achievement occurred during the Great War. As a captain of the Cheshire Regiment, T.A., he was mobilised at the outbreak of war, when working for Brunner, Mond & Company, Limited, but was recalled in connection with the manufacture of munitions. A lecture delivered at the Centenary Meeting of the Franklin Institute, Philadelphia, describes in the following terms the great task which he then successfully undertook:—

"During the Great War, the safety of Great Britain and her Allies depended at a very critical moment on the ability of an Englishman, Dr. Francis Arthur Freeth (Chief Chemist to the celebrated firm of Messrs. Brunner, Mond & Company), rapidly to devise well-founded and scientifically-controlled processes for the daily manufacture of enormous quantities of ammonium nitrate from mixtures of other salts. Freeth, a devoted and expert disciple of Gibbs, Roozeboom and Schreinmakers, solved the problem by means of the graphical methods founded on the thermodynamical theory of heterogeneous equilibria. Thus the invisible links of human thought reached across the years from the peaceful study of an American mathematician almost to the very mouth of the guns."

The late Lord Melchett referred to this achievement of Major Freeth's as having "without exaggeration saved the Allied forces in the field." Major Freeth married Miss Ethel Warbrick, of Silecroft, Cumberland, and has one son and two daughters.

Random Shots.

Visiting cards! The trouble with you travellers, representatives, salesmen and whatnot is that you think too much of selling your castings. You seem to think of nothing else but increasing the sales of your firm. Surely the recent articles in this Journal, and the correspondence which has followed, have at last convinced you of the overwhelming importance of your visiting cards. Nothing else matters! What does the buyer on whom you call want to know? Does he want to know what you sell, how good your stuff is, how cheap it is, or whether it is worth buying? No! He wants to know what your visiting cards are like. The first thing a buyer does, when he hears that a salesman waits outside the portcullis, is to call for the man's visiting card. Then he produces a large magnifying glass, or, if he is very particular, a microscope. He rarely looks at the name of the firm engraved on the card. He looks for printing errors, mistakes in lay-out, or bad taste in the wording. Then he calls in the salesman and addresses him in such words as these: "Mr. Snooks, I fear that a full-stop has been omitted from your telephone number. One of the letters in the word 'Limited' is crooked, and I think—yes, I am sure—there is a smudge—a small one—but, still, a distinct smudge on the left-hand corner of the back of your visiting card. Under these circumstances I think you will agree that I have no alternative but to ask you to discontinue your calls." On the other hand, he sometimes says: "Mr. Jinks, allow me to congratulate you on the excellence of your visiting card. In my long experience I have rarely encountered such superlative printing. The idea of rendering your address in French gives it, if I may say so, a touch of distinction, while the whole *ensemble* is both dignified and unusual. Please send me 7½ tons of whatever it is that you are selling. Good day!"

* * *

Has the buyer of your moulding machines begun to regard you with a cold and fishlike eye? He has? No doubt you think it is because the quality of your machines has deteriorated, or that the price has been doubled. Allow me to suggest that your supposition is wrong. It is because your last batch of visiting cards was badly printed on most inferior card, and your name was written by hand on a dotted line. Oh, dear! Really!

* * *

I have received a letter from a man who signs himself "Traveller of Experience" which I think may be of help to all of us.

"Sir,—In the last 70 years I have travelled no less than 45 times round the world, covering no less than 1,125,000 miles. I can, therefore, claim to know something about travelling, and particularly the selling of castings in little-known parts of the earth. I always found my visiting card of the utmost value in securing orders in difficult circumstances. For instance, I remember calling upon a Fiji chief way back in '95. Now that man used to look forward to travellers' visits. He used to cut them up in small pieces, stew slowly for four hours, and serve with parsley sauce. It did not matter whether the traveller was British, American, European or Asiatic, he treated them all in the same way—except me! I was the first man to present a visiting card engraved in Egyptian hieroglyphics, with a picture of Queen Victoria on the back and an inset photograph of Manchester Free Trade Hall on the top left-hand corner.

"In your recent leader you mentioned the 'snob' appeal of a visiting card, printed in a foreign language. I agree with you. I had cards printed in every language under the sun. I used them in rotation in the wrong country—French cards in England, English in France, Spanish in Germany, German in Spain. I found it worked very well."

Marksman.

Sand Control on a Continuous Moulding Unit in a Malleable Foundry.*

By Charles Morrison,† Saginaw, Mich.

Raw Material Storage.

All raw materials are stored in the sand building. Unloading from the trucks is done with a bucket and a 10-ton travelling crane. There are bins for storage of heap sand, sharp sand, facing sand, burnt sand, blast sand, black sand, clay and coal dust. For immediate use, small quantities of the above materials are stored in hoppers, which are filled by the crane. There are also hoppers for the storage of coal dust, moulding sand and core mixtures. All hoppers are serviced by a travelling weighing lorry, the various hoppers being covered with tarpaulin to prevent contamination.

All moulding and core-sand mixtures are made in the sand-storage building. The ingredients that go into the batches are weighed by the weighing lorry and deposited into the mixers and mullers. Batches of moulding-sand mixtures are weighed on a platform scale before entering the foundry, in order that accurate records of additions to the sand system can be kept.

Sand System.

The conditioned sand is stored in two 100-ton tanks. The feed from the tanks is alternated so that one tank is discharging while the other is filling, thus allowing the sand ample time to cool and temper thoroughly. After leaving the tank the sand passes to the elevator, from which it is discharged into the revivifier. From the revivifier, the sand is dropped on to a belt which carries it to the flight conveyors. The moulding hoppers are located beneath the flight conveyors and the sand spills into them as it travels along, the surplus falling into the tail spouts, from where it is conveyed to the shake-outs.

The moulds are dumped from the moulding conveyor on to vibrating screens which remove the sand from the castings, and the latter then are loaded into buckets and carried to the knock-out conveyor, where the gates are broken off and the castings sorted into boxes. The sprue and sand are discharged into a mill, the burnt sand is taken off and screened, and the clean sprue is discharged into a box.

The reciprocators are located beneath the shake-out screens and rake the sand on to the shake-out belt. The rebonding mixture feeds on to the tail pulley of this belt. The sand is then carried up to the magnetic pulley and falls on the vibrating screens, where pellets of iron, core particles, clay balls, etc., are removed. From the screens, the sand is discharged into the pug mill. As it falls into the pug mill, water is added through a series of jets. The coal-dust feeder is situated at this point and spills coal-dust mixture into the pug mill. The reconditioned sand then is elevated and dropped into the storage tank, where it is allowed to cool and temper before use.

Laboratory Control.

The sand laboratory supervises sand storage, core-sand mixtures, moulding sand and research. Tests for moisture, permeability and bond are taken on the moulding sand every hour, or more often if necessary. Periodic tests are made on raw materials, cores, core batches and moulding sand. Research is conducted at all times. The man in charge of sand must co-operate closely with the core and moulding departments in order to obtain the proper control. Although laboratory tests show the sand and cores to be within the specified limits of control, this does not necessarily imply that they are good cores and good sand. Many conditions beyond the bounds of test influence the quality of these materials. Intimate knowledge of every condition pertaining to the sand system is necessary in order to obtain satisfactory sand.

* A Paper read before the American Foundrymen's Association.
† Assistant Metallurgist, Saginaw Malleable Iron Division, General Motors Corporation.

Moisture.

Water is added to the dry shake-out sand through a series of jets as it falls into the pug mill. The water valve is a dial type. A pressure regulator capable of holding the pressure within one pound is situated in the water line ahead of the valve, the operating of this valve being done by the sand testers. The amount of water added is determined by the hourly tests for moisture, feel of the sand, past experience, and judgment of conditions in the system, such as the following:—(*a*) The amount of overflow sand; (*b*) the amount of shake-out sand; (*c*) the turnover of sand; (*d*) the temperature of the sand; (*e*) extent of bridging in the storage bins; and (*f*) atmospheric conditions. The effect of

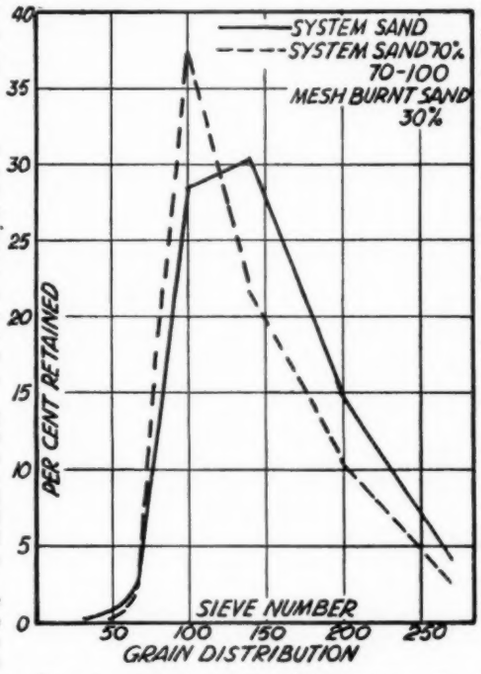


Fig. 1.—Chart showing Improvement in Grain Distribution of System Sand by the Addition of 30 per cent. Screened Burnt Sand of 70- to 100-Mesh Size.

each of the above factors will be taken up in their respective order.

The amount of overflow sand is governed by the amount of sand fed to the flight conveyors in excess of that necessary to keep the moulding hoppers full. The overflow sand should be kept at a minimum, otherwise it clogs both the reciprocators and screens. This material, being normally tempered sand, is somewhat wetter than the shake-out sand; consequently, the overflow should be kept proportional to the shake-out sand.

The amount of shake-out sand is dependent upon the rate of production. Being dry, it will require more water than overflow sand. The tester must take cognisance of the moulding rate as well as the amount and kind of sand coming from the shake-outs. The combination of shake-out and overflow sand represents the sand turnover per hour. Changes on the water valve are made with a change in turnover.

The temperature of the sand is influenced by the rate of production, the extent to which it bridges in the bins, and atmospheric conditions. As production increases, the sand temperature rises. If the sand bridges in the bins, a smaller amount turns over more rapidly and becomes hotter. On hot days the sand does not cool readily, and hot sand requires more water because it dries out faster in travelling from the storage bin to the moulding hoppers.

All of these factors must be borne in mind by the sand tester. With a good tester it is possible to hold within plus or minus 0.1 per cent. of the moisture standard 95 per cent. of the time. The percentage of moisture to be carried in the sand is determined by the class of work on the system. For large work a content of 4.8 to 5.2 per cent. is carried, and for small work a content of 5.2 to 5.6 per cent. is carried. On hot days or with hot sand this content may have to be increased.

Bond.

The rebonding mixture is added with a belt feeder to the shake-out sand belt. The feeder is equipped with a variable-speed reducer and a gate. With this arrangement the feeder becomes very flexible. This is advisable because all the addition sand is added in the rebonding mixture. Two kinds of rebonding material can be added, bonding sand or clay. When using either of these materials, additions should be made gradually and uniformly or else balling of the clay will surely result. Raw clay should not be added, as segregation will take place.

A mixture of burnt sand and clay is used. This mixture is thoroughly mulled before using, and is made as weak in clay as possible without causing an undue increase of sand in the system. Regardless of all precautions taken, some of the clay will ball and a suitable piece of machinery must be used to break up these balls. The revivifier tends to break up lumps of sand and clay balls.

Samples taken from a system using clay for rebonding after mulling for ten minutes increased in bond from 6 to 11 lbs. compressive strength, which indicates that there was considerable ineffective clay in the sand. Mulling would eliminate this objectionable condition; however, it is impractical to install a batch-type muller in a continuous-sand system where a large tonnage is used. What is needed is a continuous muller capable of handling 100 to 150 tons of sand per hour. The amount of rebonding mixture fed to the system sand is regulated from the tests for compressive strength taken each hour. For heavy work a sand strength of 4.5 to 5.0 lbs., and for light work 5.0 to 5.5 lbs. is maintained.

Permeability.

The permeability of the sand is influenced by the following factors:—(1) Fineness of the core sand; (2) percentage of clay in moulding sand; (3) percentage of coal dust in moulding sand; (4) percentage of moisture in moulding sand; (5) percentage of fines in moulding sand; (6) temperature of sand, and (7) grain distribution.

Inasmuch as all of the sand additions to the system eventually come from the cores, the fineness of the core sands more or less governs the permeability of the moulding sand. A high ineffective clay content reduces the permeability. Normal clay builds around the grains, producing an openness; but when the clay becomes burned to a point where its bonding qualities are gone, it powders, forming fines which clog the pores in the sand.

The coal dust, being fine, clogs up the sand; moreover, the ash from it will build up to a constant introducing an additional portion of fine material, and consequently, as the coal dust percentage increases, the sand becomes less permeable. The moisture content of the sand influences the manner in which it rams up. Excessively-wet sand will ram up tightly, producing a low permeability in the mould.

Coal-dust ash, dead clay and sand grains broken down through handling and heat, introduce dust into the sand which lowers the permeability. A large portion of this material is carried out through the ventilating stacks over the shakeouts. Fines are removed from the burnt sand by screening. The temperature of

the sand has a very marked influence on the permeability, cold sand being more open than hot sand. When the permeability is already rather low, it is essential that the sand be kept cool. To accomplish this, air is passed through the system sand as it falls from the vibrating screens.

The permeability is affected considerably by grain distribution. When the grain distribution is good, the sand is more open than a sand having a poor distribution with the same fineness number. The screening of the burnt sand permits certain portions to be accepted and others rejected. In this manner a certain grain distribution can be built up, thereby making the sand fairly open with a relatively high fineness number.

Fig. 1 shows the improvement of grain distribution by the addition of screened burnt sand added through the rebonding and coal-dust mixtures.

Sand in a system making large work has a permeability of 30 to 40, and for small work 25 to 35.

Coal Dust.

Coal dust has many objectionable qualities, its justification being to prevent the sand from burning on the castings and to improve the finish. Coal dust and the coke produced from it weaken the sand, the coke at times picking up clay and thus forming balls which have to be screened from the sand. Moreover, the ash from the coal dust tends to lower the permeability.

To add to its objectionable qualities, coal dust is the hardest ingredient in the sand properly to control. If a quick and accurate test (similar to moisture or bond) could be made each hour, the problem would not be so difficult. Both the burning and flotation methods for determining coal dust are inaccurate and therefore unreliable, by reason of the fact that they do not show the amount of effective coal dust present.

The most satisfactory method of controlling the coal dust is by careful observation of castings, by accurate record of all coal-dust additions to the system, and by past experience. All additions are carefully weighed, as the amount added in a day is small. To obtain good results, the percentage of effective coal dust is controlled within narrow limits. Too little coal dust permits the sand to burn on the castings, which results in heavy sand losses from the system, hampers inspection of the hard-iron castings, and causes excessive cleaning costs. In addition, the finish on the casting is not good. Blows, surface checks, shrinks, misruns, cold shuts, dirty moulding and drops are common results of too much coal dust.

There are three ways of adding coal dust to the system, as follow:—(*a*) With the rebonding mixture; (*b*) raw, and (*c*) with heap or burnt sand. The first method is not satisfactory because the amount of coal dust added is dependent upon the bond strength, inasmuch as the amount of rebond added is governed by the bond-strength tests. The second method is satisfactory, but extreme care must be taken to prevent segregation. The coal dust must be added slowly and uniformly throughout the day, and the sand must be thoroughly mixed after additions are made. The third method is most satisfactory, as it produces more uniform distribution.

The amount of coal dust that will have to be supplied to the sand to replace that burnt out will vary from time to time, due to the following conditions:—(*a*) Temperature of the iron; (*b*) size and shape of castings, and (*c*) rate of production. The higher the pouring temperature of the iron the more coal dust will be burned out of the sand. Due recognition of this fact must be made where the pouring temperature is changed.

Size and shape of the castings have a pronounced influence on the coal-dust burnout. Large work produces a hotter temperature within the mould, and as a result the sand against the casting is burned back to a greater depth than with small work. The square-inch area of casting exposed to the sand is not proportional to the weight, and it is possible with a rather light job to burn out a considerable quantity of coal dust. It is desirable to classify jobs on certain units because of this fact.

The amount of coal dust fed to the system necessarily will be changed with a change in production. Accurate records of consumption show that there is a definite relationship between weight of iron poured and coal dust consumed. As the volatile matter is the ingredient that produces the desired results in the mould, deliveries of coal should be checked for volatile matter. For large work 11 to 12 per cent. coal dust is carried in the sand, and for small work 9 to 10 per cent. is carried.

Volume of Sand in the System.

For good operation, both from the standpoint of control and economy, it is desirable to maintain a constant volume of sand in the system. The various conditions affecting the volume of sand are as follow:—(*a*) Effectiveness of the shakeouts; (*b*) percentage of coal dust in sand; (*c*) percentage of clay in sand; (*d*) nature of the cores, and (*e*) temperature of the iron. Poor shakeouts leave considerable sand on the castings, thus entailing large losses from the system. As a result, large amounts of addition sand must be made, which not only increases the costs but destroys control.

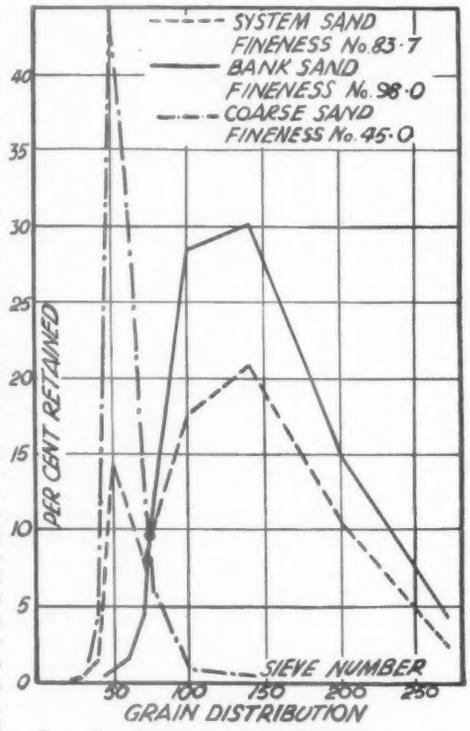


Fig. 2.—Chart showing Destruction of Grain Distribution of System Sand by the Use of Improper Coarse Sand for Open Cores.

A change in coal-dust percentage will cause a change in volume of sand. With too low a proportion of coal dust, large losses will take place; with too high a rapid sand pick-up results. A high clay content causes the sand to adhere to the castings, thus producing abnormal sand losses. The fact that the cores disintegrate at the shakeouts (thereby adding sand to the system) has an important bearing upon the sand volume. Change in baking conditions of the cores or the amount of core binder used in them will change the extent to which they contribute sand to the system

The pouring temperature of the iron will affect the extent to which the sand sticks to the castings, thus influencing the losses from the system. All additions of sand are made through the rebonding and coal-dust mixtures. The variable-speed arrangement on the rebond feeder allows very flexible control of sand additions. To add more sand, the mixture is made lean in clay, and to cut down sand additions the mixture is made rich in clay. For best operation, the largest volume of sand possible is kept in the system, which permits it to temper and cool properly; moreover, the control is less difficult.

Factors Affecting Finish.

A highly-satisfactory casting finish can be obtained by the use of a suitable facing. When facing is used, the control of the backing sand need not be so rigid, the principal requirements being that it have sufficient bond for moulding and be permeable enough to allow gas to escape from the mould. The use of facing, however, is not desirable, because it slows up production and is expensive. Where facing is not used, the necessity for a high-grade sand is obvious.

To obtain a good finish without the use of a facing is no simple task, the nature of the sand used being such that low permeability results. The foreman moulder prefers a sand that is more open than necessary to allow for discrepancies in moulding practice. When a fine sand with low permeability is used, the moulding technique necessary to make a sound casting becomes more exacting.

The finish on a casting will be no better than that produced by the coarsest particle in the sand. Most of the extraneous matter, such as clay balls, coke, rock, roots, iron shot, core particles, charcoal, etc., is removed at the vibrating screens. About 95 per cent. of the sand will pass a 40-mesh screen after passing the $\frac{1}{2}$-in. vibrating screens. Due to the shape of the sand grains, it does not matter materially whether the screen openings are $\frac{1}{8}$ by $\frac{1}{8}$ in., $\frac{1}{4}$ by $\frac{3}{4}$ in. or $\frac{1}{8}$ by $1\frac{1}{4}$ in. The size of opening used is determined by the tonnage to be put through the screens.

The coal dust is ground to pass 99 per cent. through a 70-mesh screen. Frequent tests are run to ensure that this fineness is maintained, as large particles of coal cause pits in the castings. If the coal dust becomes too coarse, serious trouble may result. Coal dust is used to improve the finish to a certain extent. However, when the percentage of this ingredient in the sand becomes too great, the surface of the casting will be covered with checks and ridges, causing an undesirable finish.

Proper moisture content and tempering are essential to good finish. Dry sand or sand that has not tempered properly will often stick to the patterns, producing very rough castings; moreover, the sand will not mould properly. This causes rough spots at the parting line, and frequently small crevices will not be filled with sand, resulting in a rough spot at that point.

Hot sand can be very troublesome. The hot sand coming in contact with the relatively cold pattern causes the water vapour to condense and the sand to stick to the patterns, thereby producing a rough casting. To prevent ordinary sticking of sand to the pattern, a suitable spray consisting of lard oil and kerosene is used. Inasmuch as the system sand has the same characteristics as the core sands, the choice of heap sands for this purpose is influenced by the desire to obtain smooth castings. Ninety-nine per cent. of the jobs are made without facing and have a fairly smooth finish. For a few jobs that require an exceeding smooth finish, a facing consisting of black sand and No. 18 Helmick is used.

Relation of Cores to Moulding Sand.

The core sands determine the fineness of the moulding sand; also, that the nature of the cores determines to some extent the volume of sand in the system. Some cores must be very open, others can be made less open. Therefore, different sands must be used for various types of cores. It is essential that the proper choice of sand for open cores be made, as otherwise the grain distribution of the moulding sand will be undesirable.

(*Concluded on page 225.*)

The International Foundry Conference in Czecho-Slovakia.*

By T. Makemson.

It is desired to emphasise that this Paper is not a description of Czecho-Slovakia and its industries, but is purely an account of the writer's personal observations and impressions gathered during a ten-days' tour of the industrial parts of the country. It is fully realised that many of those impressions may be superficial, and that further experience and observation would probably modify them or entirely alter them. Limited as one's opportunities were, however, it is hoped that the Paper may be of some value and interest.

Czecho-Slovakia came into existence after the close of the Great War, and consists of territory which previously formed parts of the Austrian Empire and the Kingdom of Hungary. Bohemia, one of the four provinces of Czecho-Slovakia, was, of course, an independent State with its own kings before it was merged into the Austrian Empire, and the Czechs have their own language and were in every sense a nation inside the Empire.

The new Republic contains most of the important deposits of minerals and the most important industrial districts of the old Austrian Empire. Some of the large works had become virtually arsenals for the supply of war material to the Austrian army and navy. On the conclusion of the war, these industries found themselves in the position of many other great armament firms, and the demand for war material shrank to small dimensions. It was necessary to find new manufactures, and they were faced with the additional difficulty in that the new country in which they found themselves offered a comparatively restricted home market, its population being only about fifteen millions. For a time the industrial establishments passed through a very critical period; they adapted themselves to the new conditions, however, with amazing energy and ability, and their success in the export trade made them formidable competitors to every manufacturing country in the world. The peak year of the country's prosperity was about 1929; since then, general world conditions, tariffs, and the condition of the exchanges have made their export position more difficult, and to-day many of their plants are working at considerably less than full capacity.

Programme of the Conference.

The International Foundry Congress which has just been held is known to the International Committee of Foundry Technical Associations, as a Congress "C," that is, a Congress in which the United States is not represented by any considerable body of members, but only by its official representative, Mr. Delport. The attendance was about 300, including about 80 foreigners. It was satisfactory to know that the British contingent, with 18 representatives, was the largest foreign deputation.

The Czecho-Slovakian Foundrymen's Association were the hosts, and were responsible for the organisation of the Congress, which was splendidly planned and carried out. Every detail had been thought out and anticipated, and the whole of the business side of the Congress ran without a hitch. The Czecho-Slovakian Foundrymen's Association celebrates its tenth birthday this year. It has 400 members in a country with about 400 foundries (a much higher proportion than in this country); it has provincial branches, holds an annual conference, issues a monthly technical review and co-operates with the Czecho-Slovakian Standards Association. The success achieved in this short period in a new country with difficult problems is due largely to the efforts and enthusiasm of its principal founder, Prof. Pisek, of Brno, who has been the President of the Association since its formation, and who was the guiding spirit in the recent Congress. Prof. Pisek's work has been recognised internationally by his election as President of the International Committee for the year 1934.

The Conference proper was held in the Municipal Library, Prague, and commenced on Saturday morning, September 9, with a ceremonial opening presided over by Mr. J. Dostalek, the Minister of Public Works, and an engineer by profession. Mr. Maas Geesteranus, the President of the International Committee, replied in four languages, and the official delegates of the foreign delegations tendered their greetings, Mr. Faulkner speaking for Great Britain, and Mr. Delport for the United States. At the conclusion of the ceremonial opening, the reading and discussion of Papers proceeded in three simultaneous sessions.

The whole Conference lunched together, and then visited the exhibition of artistic iron castings at the Museum of Industrial Art. Later in the afternoon a reception was held by the Mayor of Prague, during which the guests sampled a special and limited vintage of the *vin du pay*, and in the evening the whole party met together again for dinner.

Four simultaneous sessions of Papers were held on Sunday morning. The British Exchange Paper on "Inverse Chill in Grey Irons" by the President of this Branch, Mr. Kain, was Paper number one in the Cast-Iron Session. After lunching together again, the afternoon was occupied by various sightseeing excursions, but a very limited number of delegates, including one British member, Mr. Faulkner, devoted the afternoon to more serious pursuits, and visited the Prague Sample Fair. Another informal dinner concluded Sunday.

Monday morning was devoted to works visits of which there were four alternative programmes, and after lunch at the Wilson Station about 110 members and ladies, including the whole of the eighteen in the British party, commenced the tour of the country by special train. The tourists arrived at Moravska Ostrava after a five and a-half hours journey. Moravska Ostrava and the adjoining town of Vitkovice form a big industrial community.

Tuesday was occupied by visits to the steelworks and coke ovens, and on Wednesday morning train was taken to Zlin and the day was spent in the Bata shoe factories; later in the day the journey was continued to Brno, where Wednesday night was spent. Thursday morning was occupied by visits to works in Brno, and after lunch the special train departed for Pilsen, which was reached at 10 p.m. after a seven-hours journey. Friday and Saturday were officially occupied by works visits, and the Congress was closed by a banquet on Saturday evening. On Sunday most of the delegates dispersed.

Alternative works visits were offered on three days, and it is only possible to give descriptions of those works which the writer selected for his own visits. As far as can be gathered, however, the conditions, methods and equipment at the other works were not unlike those at the works which he had the privilege of inspecting.

WORKS VISITS.

Ceskomoravska-Kolben-Danek, Limited.

The manufactures of this company, which was formed by a merger of three other companies, include steam turbines, generators, transformers, electric motors, water turbines, locomotives, domestic pumps and brewing machinery. There is also a separate factory for the manufacture of motor-cars. The company has about 15,000 employees, though in busier periods they have employed 25,000. The works are situated on the outskirts of the City of Prague.

The visit commenced with a very brief visit to the steel foundry, where the melting plant consists of three acid open-hearth furnaces of 20, 15 and 7 tons capacity respectively. The visitors had just a brief glance into this foundry, although they saw many of its products in other parts of the works, and the quality in every case was of an exceptionally high order. Among the castings seen were a number of locomotive side frames of about 35 ft. long and several castings consisting of locomotive cylinders and saddle cast in one piece.

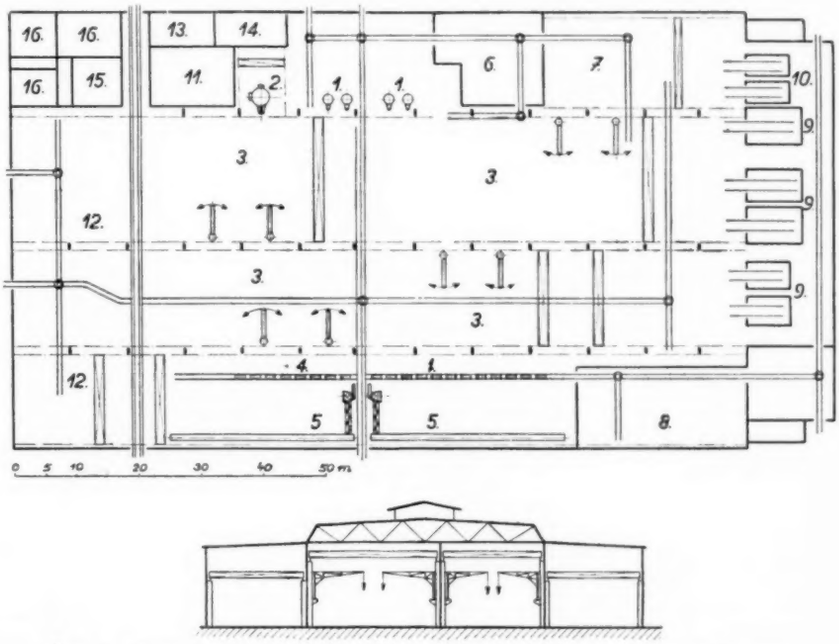


Fig. 1.—Plan of the Grey-Iron Foundry of the C.K.D. Company at Prague.

1—Cupolas. 2—Electric furnace. 3—Moulding floor for small castings. 4—Mass Production Section. 5—Sand Preparation Plant. 6—Sand Preparation Plant. 7—Large Core-making shop. 8—Small core-making shop. 9—Mould-drying ovens. 10—Core-drying ovens. 11—Transformer room. 12—Fettling shop. 13—Mechanical testing laboratory. 14—Electric furnace control panels. 15—Stores for patterns in use. 16—Offices.

* A Paper read before the London Branch of the Institute of British Foundrymen, Mr. C. H. Kain presiding.

Malleable Iron Foundry.—The variety of work is considerable, and the castings are comparatively heavy and bulky as malleable castings go. The malleable cast iron is melted in the same furnaces as the steel, the malleable-iron charge following the steel charge. Malleable castings are annealed in a large gas fired furnace charged from the top through the roof, which was in sections. Cast-steel annealing boxes are used, and they are of considerable capacity, about 2 ft. dia. and 3 ft. deep; 0.5 per cent. of copper is added to the steel used for making these boxes, and it is claimed that their life has been prolonged as follows: When used indiscriminately for steel of malleable castings, addition of copper has prolonged the life from 60 to 80 heats, and when used exclusively for annealed malleable castings, life prolonged from 25 to 30 heats.

Fig. 2.—The Grey-Iron Foundry of the C.K.D. Company, showing Small-Castings Plant equipped with Overhead Sand Distribution to the Machines from the Centrally-Situated Preparing Plant.

Non-Ferrous Foundry.—The non-ferrous foundries, particularly those devoted to the light alloys, are of considerable interest. A special section is devoted to the making of castings in Electron metal, a magnesium and copper alloy with a specific gravity of 1.2 and the melting point of 520 deg. C. Crankcases and other automobile castings, commonly made in aluminium, are now being manufactured in this metal; the treatment presents one or two points of interest.

Casting temperature is very important, and it has been found that a casting temperature of just over 600 deg. C. gives the best results. The metal is melted in iron pots and poured into the casting ladles which are allowed to stand, each pot with a pyrometer inserted, until the metal has cooled to the correct casting temperature. The method of running the moulds is also important. The vertical down runners consist of cores, each core forming three or in some cases four narrow down gates. Horizontal gates carry the metal to each side of the mould, and the ingate is almost continuous. Chills and denseners are employed extensively.

Most of the moulds in this foundry were made on Ronceray machines. The sand used for this work is treated with a ¼ per cent. of boron to give the necessary bond, and a considerable amount of sulphur, stated to be 5 per cent., is added to the sand to act as a deoxidiser and to prevent surface defects. We were given to understand that this metal is not particularly resistant to corrosion, and in cases where higher corrosion resistance is required, the casting is dipped in a solution of potassium bichromate; the casting then has a bright golden colour.

A considerable number of aluminium die-castings are made, the "Y" alloy being generally used. The company also makes die-castings of a 6 per cent. silicon alloy, and a 12.6 per cent. silicon alloy (Alpax type).

Brass Foundry.—The general brass foundry is equipped with four 600-lb. Morgan gas-fired tilting furnaces. There is also an oil-fired furnace, and there are a number of crucible pit-fired furnaces.

The Iron Foundry.—The iron foundry was built in 1929, and is 400 ft. long and about 220 ft. wide. Practically all the iron castings required by the company are made here, the variety, therefore, is very considerable. In addition to the overhead cranes, each wall of each of the larger bays is served by a 5-ton travelling jib crane on a gantry lower than that used by the overhead cranes.

There are four cupolas, two of which have an internal diameter of about 30 in. and two of about 36 in. The distance from the bottom to the charging door appeared to be unusually high. All cupolas are equipped with receivers—a common Continental practice—and there is a hinged door at the front of each receiver for cleaning purposes, the spout being attached to the door.

We were told that practically no alloy cast irons are made, steel scrap is used only up to 10 per cent.; they use a considerable amount of iron scrap, some hematite and the balance is ordinary foundry pig. There is also a 1½-ton Héroult electric furnace, which was installed for refining cast iron in connection with a duplex process, but we understand that it is not now used.

There are four bays, the two centre bays being devoted to heavy work in dry sand and loam, and the moulding practice appears to be similar to our own. For smaller work on a repetition basis, there are a number of moulding machines, practically all of the press turn-over type, and in this section of the foundry there are gratings in the floor with underground conveyors for the return of used sand.

Core-Blowing Machine.

A core-blowing machine of the "Revolun" type was at work in the iron foundry, and was making small cores, apparently for a valve or stop-cock. One man was operating the machine and two women on an adjacent bench were engaged in taking out the cores, cleaning the boxes and assembling them again. There were four boxes in use, whilst one was being rammed, each woman was emptying and preparing two other boxes, and the fourth appeared to be a stand-by. The capacity of the machine was considerable, and the time occupied in making the core was less than the time taken by the two women in preparing the boxes.

Although there was a considerable amount of good equipment in the iron foundry, we were impressed by the amount of work which was still being carried out from loose patterns. Several small jobs were noticed, and from the number of moulds on the floor, the orders were not small, yet they were being made entirely by ordinary hand-moulding methods.

The Pattern Shop.—The pattern shop is a magnificent building on the ground floor. There is an abundance of machines of modern type and in good condition. An English machine, the Wadkin wood worker, appeared to be doing its best to uphold British traditions.

Timber is stored in the basement and the stores are equipped with a very complete timber-drying plant. The plant consists of three kilns and the necessary steam-raising and air-heating plant. The process is as follows. Planks of unseasoned timber are loaded into a truck which is run into the kiln. The kiln is saturated with steam for 5 hrs., by which time the steam is considered to have driven out the natural sap from the timber. By an arrangement of valves, the same steam is then used to heat air which is circulated through the kiln for approximately 7 days at a temperature of 50 deg. C., and thus dries out the moisture with which the timber has been saturated.

The boiler plant supplying the steam adjoins

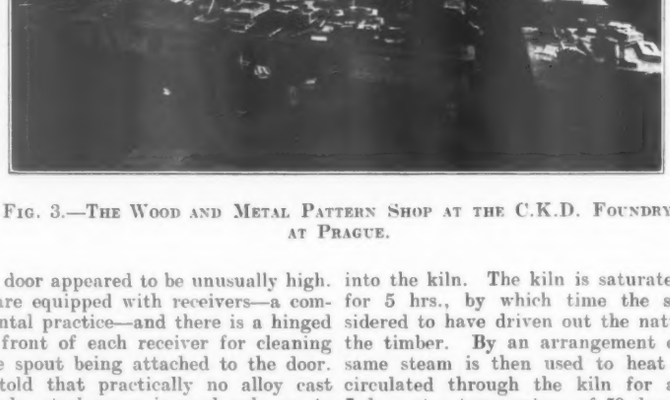


Fig. 3.—The Wood and Metal Pattern Shop at the C.K.D. Foundry at Prague.

the kilns, the fuel consisting almost entirely of shavings, waste timber and other rubbish from the pattern shop itself. This was an extremely fine plant, and, although the writer noticed that much of the dry timber was warped, there did not appear to be any considerable signs of cracking, and it was claimed that the warping did not cause any considerable trouble.

Production.

The following figures were given of the total capacities of these foundries:—

Iron Foundry.—Castings up to 50 tons, annual possible production, 10,000 tons.

Steel Foundry.—Annual output, 4,000 tons.

Malleable Cast-iron Foundry.—Annual output, 1,200 tons.

The general impression of this works was that the equipment is good, but not particularly novel, but the work as a whole was of the very highest possible quality. Much of the work being done demands thoroughly high-class castings, and the equipment, lay-out, organisation and quality of the products compare favourably with the very best that one sees in any works in this country.

One did not see any signs of efforts being made towards large and cheap production, and we were informed that this policy is deliberate. This company is forced to endeavour to create a large export market, and it is essential that the plant be sufficiently flexible to cover a very large variety of work. It is difficult to specialise to any considerable extent; the policy, therefore, is to have good plant, but not a highly-specialised plant.

The Vitkovice Works.

The works of the Vitkovice Mining, Steel & Ironworks Corporation are situated at Vitkovice, a town which adjoins Moravska Ostrava in the most extensive coalfield in the country. This town is close to the Polish frontier, and the same coalfield extends into Poland. The company manufactures pig-iron, steel and iron, and steel castings; it has an extensive constructional and general engineering business and operates collieries, coke ovens, ore mines and a refractory-manufacturing plant. The iron and steel works alone cover an area of 10 sq. kilometres and in normal times the organisation has 35,000 employees.

Fig. 4.—View of the Ardelt Pipe-Casting Plant at the Vitkovice Works.

There are two blast-furnace plants, one with three blast furnaces, which we visited, and another plant nearly a mile away, with two blast furnaces. The two plants are connected by a gas main 1.2 kilometres in length and 2,500 mm. (nearly 9 ft.) in diameter, and a blast main of the same length, 1,600 mm. in diameter. There are also 2½ kilometres of gas mains to convey blast-furnace gas to various points in the works. Four of the blast furnaces have an average daily production of 500 to 600 tons of pig-iron (the largest produces 850 tons per day), and the fifth furnace, which is engaged mainly in producing ferro-manganese, has a daily production of about 350 tons. Basic pig, foundry pig with about 0.8 per cent. phosphorus, and hematite iron are manufactured, and the production of pig-iron of all kinds in 1929, the peak year, was about 750,000 tons. The three furnaces which we saw were not of the most modern type, though the auxiliary plant was more up to date than the actual furnaces. An electrolytic gas-cleaning plant is extremely ingenious, and it is claimed that it is the first of its type in the world.

There are two open-hearth steelmaking plants. The more modern plant consists of eight basic open-hearth furnaces, four of which are each of 200 tons capacity; the capacities of the other four vary from 60 to 180 tons. Two 60-ton furnaces are stationary; all the remainder are of the tilting type. The tilting furnaces work with about 80 per cent. hot metal from the blast furnaces, the remainder of the charge being scrap, the stationary furnaces work with about 45 per cent. hot metal. The analysis of the hot metal was given as: C, 3.2; Mn, 2.2; Si, 0.35; P 1.9; and S, 0.10 per cent. At one time a mixer was in operation, but the mixer has been converted into a furnace and the mixing of hot metal of various analyses is done direct in the tilting furnaces. The open-hearth plant was well laid out and splendidly equipped.

Fig. 5.—The Heavy Foundry at the Vitkovice Works.

Rolling Mills.—The rolling mills are of very up-to-date design and lay-out. They consist of a roughing mill, an armour-plate mill, three other mills for plates and sheets, and mills for rails, sections for structional work and various mills for strips and rods. The equipment is designed for quick rolling to avoid reheating as far as possible, and in a test it was observed that the time taken from weighing the ingot before entering the roughing mill to the finished product of about 100 mm. square in section was 5 min. 2 sec. Particular interest was shown in a large plate-annealing furnace about 17,000 mm. in length and 4,200 mm. in width (about 60 ft. by 14 ft. 9 in.). The rolling-mill equipment is electrically driven and the entire plant is a wonderful display of modern engineering. The company also operates a tube-rolling mill.

Steel and Iron Foundries.—The other open-hearth plant is of older design and supplies steel for the production of forgings and also for the steel foundry, which is situated in the same group of buildings. The capacity of the steel foundry is nearly 10,000 tons of castings per year, and they vary from 8 ozs. to 80 tons in weight. The larger steel castings consist of shipbuilding castings; railway material is also made in considerable quantities. The iron foundry is said to be the largest in Czecho-Slovakia, though in lay-out it is not nearly so impressive as the Skoda iron foundry, to which reference will be made later. It consists of four sections: (*a*) heavy work, largely ingot moulds, (*b*) general engineering castings of medium weight, (*c*) a light-castings department employing moulding machines and a semi-continuous casting plant and (*d*) a pipe-making section. The section for castings of medium weight is served by seven cupolas varying in capacity from 4½ to 7 tons per hour each, and in the heavy section there are four 12 ton per hour cupolas and two 35-ton air furnaces. Individual castings up to 100 tons weight have been made in

this section. It was noted that the cupola spouts in this section were about 8 ft. long, hinged about half-way along their length. In the pipe-making section the moulds are rammed vertically by means of a machine equipped with a number of rammers, the height of which is adjustable as ramming progresses. The moulding boxes are mounted on a revolving table. Most of these tables are sunk in pits, the upper parts only being above the floor level; one set was noticed, however, where the whole of the equipment was above the floor level. In this case the ladle of metal had to be hoisted to a considerable height during the operation of casting. The pipes varied from about 4 in. internal diameter to about 2 ft. diameter and all appeared to be about five metres in length.

Fig. 6.—The Semi-Automatic Plant erected for the Small-Castings Section of the Vitkovice Works.

All the pipes which were seen were excellent castings with a fine finish, and the same remarks apply to most of the other castings seen in this foundry.

Time permitted of only a cursory inspection of the extensive machine shops, erecting and constructional shops and the forges, in one of which we noticed two Davy presses, one of 6,000 tons and one of 4,000 tons, one of which was engaged on the production of a large shaft for the Ceskomoravska Company.

Fuel Economy.

Considerable economy has been effected in the consumption of fuel by this company. In 1929 the entire consumption of fuel, including coal and gas, per ton of ingots produced was 45.7 per cent. of the consumption in 1920. This striking result is partly accounted for by the larger output, which in 1929 was nearly double the output in 1920, but was mainly due to reorganisation directed to the utilisation of surplus energy. In this connection the methods of using waste gases are of interest. Blast-furnace gas is stored in a gasometer of 50,000-cub.-ft. capacity, and coke-oven gas in a smaller gasometer. Blast-furnace gas is used for heating the coke ovens and the coke-oven gas is consumed in the open-hearth furnaces. Blast-furnace gas is, of course, used in the blowing engines and for driving 10 large double-cylinder gas-engine sets for the generation of electric current. The distribution of blast-furnace gas is as follows:—

	Per cent.
Blast-furnace stoves	27.0
Boilers	1.2
Blowing engines	10.7
Electric-current generators ...	24.8
Coke ovens	10.8
Open-hearth plants	7.7
Miscellaneous and losses... ...	17.8
	100.0

The following table shows the distribution of coke-oven gas:—

	Per cent.
Open-hearth plant No. 1 ...	42.7
Open-hearth plant No. 2 ...	14.0
Rolling mill	14.5
Tube mill	13.2
Miscellaneous	15.6
	100.0

Additionally, 420 tons of coal are burnt daily in gas producers when the works is in full operation, the producer gas being used for the open-hearth plants and the rolling mill. Waste-heat boilers are employed extensively for steam raising, and it has been found that the temperature of the cooling water in the gas engines can be raised above the usual temperature without detriment to the engines, and the hot water from the gas engines is used for heating purposes in the works and in the works hospital.

A very long and arduous but interesting morning at this works concluded with a visit to the refractory works, and the whole company was entertained to lunch by the company. Visits were paid to the coke ovens in the afternoon, but the writer had to abandon this part of the visit in order to join the deputation which visited the President of the Republic.

Bata Shoe Factories.

For the same reason the writer was unable to participate in the visit to the Bata Shoe Factories at Zlin, which took place on the following day, but other members of the party supplied some interesting information regarding this gigantic concern, which has grown up around the village of Zlin, as a result of the remarkable genius of Mr. Bata, who was killed in an aeroplane crash about a year ago. The concern is now under the control of a younger brother who was a member of the Conference Honorary Committee. About 150,000 pairs of boots and shoes are manufactured each day; the company also makes socks and stockings and rainproofs. The factory consists of a number of enormous multi-storey buildings the walls of which are largely of glass, and on the outskirts are a number of large apartment and tenement houses and also small private houses for the accommodation of the employees and their families. Hospitals, museums, libraries, schools, and all the usual buildings of a large community have been erected by the company, and in carrying out this work the company has had to erect extensive engineering shops. The foundry is engaged in the manufacture of a large variety of castings, and the pipes required for water, sewage and other purposes are made in a centrifugal-pipe plant. The visitors were much impressed by their visit to Zlin, but one gathers that the enormous area they had to cover left them very tired.

Uxa Bros., Brno.

This is a comparatively small foundry company making, generally, grey-iron castings and malleable castings. The total number of employees is about 250. In the grey-iron foundry there are two cupolas each of 800 mm. diameter and each of a capacity of 4½ tons per hour. The cupolas are of modern type, and are not provided with receivers.

A considerable amount of general jobbing work is carried out, the procedure being similar to British; additionally, a large number of motor-cycle air-cooled cylinders are produced, and it was rather surprising to find that the production of this type of casting is comparatively small; the quality, however, is extremely good. The moulds are made on press-rammed turn-over machines, but they have discarded machine-ramming and ram by hand, using the machines only for pattern-drawing. A certain amount of hand-finishing of the moulds is done and the moulds are dried. From our observations it appeared that the output was about 25 boxes per day, per man, of two single cylinders in a box.

The procedure was very different from what one has found in some modern automobile foundries, and one can only assume that the low production is compensated for by lack of overhead charges upon expensive equipment. Another interesting casting which was being made in large quantities was a small rectangular block with a screw-hole cast in it of approximately ⅜-in. dia. The core was made in oil sand, a screw gauge was tried into each casting as it came from the fettling shop, and in every example which we tried the gauge fitted perfectly. We were told that 90,000 of these castings have been supplied to customers, and there have been no returns.

The malleable-iron foundry is the larger of the firm's two foundries, and was exceptionally interesting on account of the type of work carried out and the fine finish of the castings. The white-heart process is used, and the metal is cupola melted, there being two cupolas about the same size as those in the iron foundry. The productions for the most part are very light castings; we noted large quantities of chain, a large order for malleable-iron scissors for the Army, bottle openers and numerous miscellaneous light articles.

Metal patterns mounted on plates are used with press turn-over machines. One man appeared to be putting down about 25 boxes of miscellaneous castings per day, each box containing quite a large quantity of small castings. Annealing was carried out in small iron pots about 1 ft. 6 in. square and 1 ft. deep.

The quality of the work turned out in this foundry was exceptionally good. The castings were beautifully finished and exceptionally clean, and the tests showed that results quite up to British practice were being obtained.

About fifteen patternmakers are employed in the metal-pattern shop, which is equipped with exceptionally modern and up-to-date machine tools. There is a well-equipped testing department and a first-class chemical laboratory. The general impression was of an extremely well-managed up-to-date plant; the area of the works is comparatively small, but every available inch of space is economically used.

(To be continued.)

High-Alloy Chrome Steel for Chemical Plant.—In the "Chemische Fabrik." K. Roesch and A. Claeberg deal with the properties and composition of high-alloy chrome steels for the construction of chemical plant, pointing out the effect of chromium and carbon on the corrosion resistance of Fe-Cr-C alloys. A cast chrome-steel, containing 28 to 30 per cent. Cr and 1 per cent. C possesses physical and chemical properties suitable for chemical plant.

Influence of Beryllium on Steel.*

By J. H. S. Dickenson and W. H. Hatfield, D.Met.

(*Abridged.*)

Introductory.

The investigation described in the present Paper was carried out jointly in the research departments of The English Steel Corporation and Messrs. Thos. Firth & John Brown, Limited, at the request of the Air Ministry, who provided metallic beryllium, of 98 per cent. purity, for the purpose.

The investigation was planned to have a limited and severely practical scope, the object being to determine whether the addition of beryllium to selected specific types of steel largely used in aircraft and aero-engine construction was likely to offer any direct benefit, by improving the physical characteristics of the material, especially with regard to the mechanical properties and resistance to corrosion.

Neither the investigation as planned, nor the present Paper, which puts on record most of the principal results, purports to constitute an exhaustive study, in the full scientific sense, of the effect of beryllium on steels in general. As the amount of beryllium available was limited, it was decided, at the outset, that a long series of quite small ingots of varying composition would be less directly useful, and give less practical information, than a few crucible ingots each of about 50 lbs. weight, a mass all too small from some points of view, but probably adequate for the purpose.

Introduction of the Alloy.

As was anticipated, difficulty was at once encountered in introducing an effective percentage of this very light element into molten steel. At the first attempt, two plain carbon steel crucible charges of about 50 lbs. each were melted at the same time, the intention being to add 10 ozs. of beryllium to one of them, equal to 1.2 per cent. of beryllium, in the hope of obtaining 1 per cent. of residual beryllium. When the steel was molten about 0.2 oz. of beryllium was added in the form of small pieces, but this immediately floated on the top of the metal in the crucible, and the remainder, making 10 ozs. of beryllium in all, was placed in a number of small iron tubes which were thrown into the crucible, a similar quantity of iron tubes, but without any beryllium filling, being added to the steel in the companion crucible. It was noted that as the tubes melted, some beryllium floated upwards to the top; in due course the two ingots were cast, and each was analysed at the following three positions:—

A.—About 1 in. above the bottom.
B.—Opposite the shoulder at the top.
C.—About 2 in. below the shoulder.

The results were as shown in Table A (per cent.):—

TABLE A.—*Analyses of Ingots Nos.* 13701 *and* 13702.

Ingot No. (13701).	*A.*	*B.*	*C.*
Ordinary.			
Carbon	0.22	0.24	0.21
Manganese	0.45	0.41	0.44
Silicon	0.22	0.27	0.22
Sulphur	0.021	0.021	0.022
Phosphorus	0.019	0.017	0.018
Nickel	Nil	Nil	Nil
Chromium	,,	,,	,,
Ingot No. (13702).	***A.***	***B.***	***C.***
Special.			
Carbon	0.26	0.29	0.25
Manganese	0.63	0.62	0.64
Silicon	0.55	0.60	0.54
Sulphur	0.023	0.023	0.024
Phosphorus	0.019	0.021	0.019
Nickel	Nil	Nil	Nil
Chromium	,,	,,	,,
Beryllium	0.48	0.46	0.45

The special ingot contains a higher content of manganese and silicon than the straight carbon ingot, probably because of an interaction between the beryllium and the oxides of manganese and silicon normally formed in a straight carbon cast. As more than 50 per cent. of the added beryllium was lost, the "crozzle" formed at the top of the crucible was analysed, with the following results (per cent.): Silica (SiO_2), 14.20; ferrous oxide (FeO), 10.78; alumina (Al_2O_3), 4.89; beryllium oxide (BeO), 56.50; manganous oxide (MnO), 5.85; lime (CaO), 2.51; magnesia (MgO), 1.02; metallic iron (Fe), 4.10.

As this method of introducing the beryllium proved unsatisfactory, the next attempt consisted of enclosing the beryllium in a mild-steel box which could be pushed below the surface of the molten steel. This time, the intention was to make a pair of 13 per cent. chromium-steel ingots, each containing 0.3 per cent. of carbon, one of them having 1 per cent. of beryllium in addition; but the analyses, taken at the same positions as before, were as shown in Table B (per cent.):—

TABLE B.—*Analyses of Casts Nos.* 15357 *and* 15358.

Cast No. 15357.	*A.*	*B.*	*C.*
Carbon	0.62	0.66	0.63
Manganese	0.26	0.27	0.27
Silicon	0.55	0.53	0.50
Sulphur	0.035	0.038	0.036
Phosphorus	0.022	0.021	0.023
Nickel	0.12	0.12	0.12
Chromium	13.32	13.43	13.43
Cast No. 15358.	***A.***	***B.***	***C.***
Carbon	0.72	0.75	0.73
Manganese	0.47	0.45	0.47
Silicon	1.75	1.96	1.71
Sulphur	0.033	0.034	0.036
Phosphorus	0.024	0.025	0.023
Nickel	0.12	0.12	0.11
Chromium	13.32	13.50	13.20
Beryllium	0.30	0.33	0.32

These steels were obviously most unsatisfactory for purposes of comparison, partly on account of differences of composition and partly because the carbon was far too high in both, whilst only a 25 per cent. yield of beryllium was obtained. There was serious attack on the crucible, due to a considerable delay involved in the addition of the beryllium, and this accounts for the "pick-up" of both carbon and silicon.

The chromium steel, the casting of which was held back in order to give strictly comparable treatment with the one containing beryllium, also had its composition seriously affected by the delay. Further casts were not considered necessary for the purpose of investigating beryllium-bearing steels of this type.

The third trial, which was made with a pair of austenitic stainless-steel ingots of the 18 per cent. chromium and 8 per cent. nickel type, was much more successful. In this case, the contents of the two crucibles were melted together, and one of them was cast, when ready, direct from the crucible into a 3-in. sq. ingot mould. The empty crucible was then replaced in the furnace for a short time to heat up, and was again drawn and placed in position under a pre-heated refractory tundish, above which a funnel was arranged. The metal from the second crucible was then poured into the tundish, whilst at the same time 10 ozs. of crushed beryllium were trickled steadily from the small funnel placed above, the mixture passing into the hot crucible below. When, in about 15 secs., this operation was finished, the steel from the lower crucible was cast direct into another 3-in. ingot mould, the total extra time after the casting of the first ingot being 13 min.

Analyses were made on drillings taken from the three positions of the ingots as in the two previous steels, with the following results, shown in Table C (per cent.):—

TABLE C.—*Analyses of Casts Nos.* 18127 *and* 18128.

Cast No. 18127.	*A.*	*B.*	*C.*
Carbon	0.19	0.20	0.20
Manganese	0.23	0.22	0.23
Silicon	0.63	0.65	0.63
Nickel	7.79	7.76	7.76
Chromium	17.52	17.44	17.52
Cast No. 18128.	***A.***	***B.***	***C.***
Carbon	0.19	0.17	0.21
Manganese	0.24	0.23	0.23
Silicon	0.63	0.68	0.64
Nickel	7.8	7.74	7.74
Chromium	17.31	17.36	17.36
Beryllium	1.03	0.99	1.04

A small piece of skull from cast No. 18128 showed, on analysis, 0.19 per cent. of carbon and 1.09 per cent. of beryllium, which was further evidence of homogeneity.

This last method of making the beryllium addition was considered entirely satisfactory, and it was, therefore, adopted without modification in the production of the remaining steels of the series, which consisted of a pair of 3½ per cent. nickel steel ingots, and a pair of nickel-chromium steel ingots of the 3½ per cent. nickel, ¾ per cent. chromium type. In each of these four cases the drillings for chemical analysis were taken at positions 2 in. below the dozzle, and about 1 in. above the extreme bottom end, with the results (per cent.) shown in Table D.

Carbon Steels.

Macro-Examination of Ingots.—As a first step, the two ingots were cut across 1 in. above the bottom end, and 1 in. below the shoulder, the sections being etched with Heyn's reagent. Beyond a suggestion that the columnar crystals were rather better developed in the beryllium-bearing ingot, there was no significant difference observable, and, structurally, either ingot might be considered normal. As it had not been convenient to employ a dozzle when casting No. 13702, the top end of this ingot was piped.

Critical Changes.—The beryllium-bearing ingot No. 13702 showed the peak of the Ac, change at 753 deg. C., or about 15 deg. higher than that

TABLE D.

Ingot No.	Position.	C.	Si.	Mn.	S.	P.	Ni.	Cr.	Be.
A	(*a*) bottom	0.31	0.113	0.44	0.011	0.018	3.63	0.03	—
	(*b*) top	0.31	0.103	0.41	0.012	0.019	3.60	0.04	—
B	(*a*) bottom	0.30	0.099	0.43	0.011	0.018	3.44	0.01	0.90
	(*b*) top	0.31	0.113	0.42	0.011	0.017	3.43	0.04	0.90
C	(*a*) bottom	0.33	0.108	0.46	0.014	0.019	3.71	0.79	—
	(*b*) top	0.33	0.103	0.44	0.014	0.019	3.74	0.80	—
D	(*a*) bottom	0.37	0.141	0.41	0.011	0.019	3.48	0.80	0.98
	(*b*) top	0.37	0.165	0.41	0.012	0.018	3.47	0.80	0.99

* Paper read before the Autumn Meeting of the Iron and Steel Institute at Sheffield.

of the companion carbon-steel ingot. The Ar_3 and Ar_2 changes were similarly lowered by about 20 deg. and 35 deg. respectively, the Ar_1 point being the same in both cases.

Forging, Heat Treatment and Mechanical Testing.—The top half of each ingot was reduced under the hammer to 1⅛-in. dia. and the bottom half to 2½ in. dia., at initial forging temperatures of 1,075 deg. to 1,080 deg. C. Both ingots forged quite well, and neither showed any signs of cracking.

The following test results were obtained from 1⅛-in. dia. test bars after normalising at 900 deg. C. in each case:—

	No. 13701.	No. 13702.
Yield points. Tons per sq. in. ..	20.6	32.4
Maximum stress. Tons per sq. in.	30.6	48.8
Elongation on 2 in. Per cent. ..	37.4	16.0
Reduction of area. Per cent. ..	64.0	19.5
Izod impact test. Ft.-lbs. ..	86, 91, 86	2, 3, 3

The very marked hardening effect due to the 0.46 per cent. of added beryllium was also noticed when Brinell tests were made on the forged bars, which had been allowed to cool normally in air after finishing, the results being:—

	Brinell No.	
	No. 13701.	No. 13702.
2⅛-in. diameter bar as forged ..	126	235
1⅛-in. „ „ „ ..	131	241

In view of the foregoing results, it was not thought necessary to carry out any further tensile and impact testing, but series of bars from both ingots were subjected to various heat treatments and Brinell tested, with the results shown in Table I, which serve further to show that a relatively small addition of beryllium has a very pronounced hardening effect on a 0.27 per cent. carbon steel.

Table I.—*Brinell Results after Heat Treatment.*

Heat treatment.	Brinell No.	
	No. 13701.	No. 13702.
Water-quenched 900 deg. C. ..	131	387
Oil-quenched 900 deg. C.	149	255
Air-cooled 900 deg. C.	131	228
Muffle-cooled 900 deg. C.	116	255
Water-quenched 700 deg. C.	179	229
„ „ 750 „	196	282
„ „ 800 „	183	309
„ „ 850 „	248	492
„ „ 950 „	202	428
Water-quenched 850 deg. C., tempered 100 deg. C.	212	430
Water-quenched 850 deg. C., tempered 200 deg. C.	170	375
Water-quenched 850 deg. C., tempered 300 deg. C.	217	418
Water-quenched 850 deg. C., tempered 400 deg. C.	217	364
Water-quenched 850 deg. C., tempered 500 deg. C.	156	286
Water-quenched 850 deg. C., tempered 600 deg. C.	143	284
Water-quenched 850 deg. C., tempered 700 deg. C.	131	241

Micro-Examination.—Microsections were cut longitudinally from the forged test-bars. They were etched by immersing them in a solution of 2 per cent. nitric acid in alcohol, both specimens requiring an immersion of 20 sec. to develop the structure completely. The structures after a normalising treatment at 900 deg. C. showed no appreciable difference in the grain size of these steel specimens at a magnification of 200, but the ferrite boundaries in the beryllium steel were much less readily resolved, and the pearlite showed no suggestion of lamination.

13 per Cent. Chromium Steels.

Macro-Examination.—As with the previous pair, each ingot was cut across 1 in. above the bottom and 1 in. below the shoulder, but this time the transverse sections were etched in an acid solution of ferric chloride at room temperature, which revealed a very material difference in the primary crystallisation of the two ingots. The plain chromium steel showed little columnar development, whilst the beryllium-bearing ingot exhibited marked columnar growth. Further, the plain chromium ingot contained numerous scattered porous areas throughout the ingot in addition to a heavily-segregated centre, whilst the beryllium ingot was reasonably sound, with normal centre segregate. Both these ingots were free from piping, but it was clear that the non-beryllium-bearing ingot was not quite normal nor structurally representative of its type, due to the delay in casting.

Critical Changes.—Heating and cooling curves were determined, but, in view of the unfortunate difference in the general composition of these two ingots, and the fact that neither represents any present or possible composition of stainless steel, it is not considered necessary to reproduce the curves.

Forging, Heat-Treatment and Mechanical Testing.—Both ingots were given a preliminary 6-hr. low-temperature pre-heating, and were then heated to 950 deg. C. for forging. A preliminary light pass having shown the material to be too stiff to forge, in each case, the temperature was raised to 1,050 deg. C. when both ingots forged satisfactorily and without cracks, the upper part of each ingot being reduced to a 1½-in. round, and the remaining lower portion to a 2½-in. round. It was noticed that the beryllium-bearing ingot No. 15,358 was somewhat "stiffer" during forging than the companion ingot. In view of the practically useless analyses of these two ingots, no series of tensile tests or impact tests were taken from treated bars, but the Brinell numbers obtained after a variety of heat-treatments, recorded in Table II, show that there is no marked difference in the hardness characteristics of the two steels. It is difficult to arrive at any conclusion regarding the influence of beryllium in this case, owing to the wide deviation in the carbon and silicon contents of the two ingots.

Table II.—*Brinell Results on 13 per cent. Chromium Steels.*

Heat treatment.	Brinell No.			
	No. 15357.		No. 15358.	
Water-quenched 700 deg. C. ..	327	329	313	317
„ „ 750 „ ..	325	323	321	315
„ „ 800 „ ..	288	295	278	276
Water-quenched 950 deg. C., tempered 100 deg. C. ..	611	601	596	611
Water-quenched 950 deg. C., tempered 200 deg. C. ..	538	547	534	530
Water-quenched 950 deg. C., tempered 300 deg. C. ..	530	522	522	514
Water-quenched 950 deg. C., tempered 400 deg. C. ..	522	526	538	538
Water-quenched 950 deg. C., tempered 500 deg. C. ..	522	526	522	526
Water-quenched 950 deg. C., tempered 600 deg. C. ..	349	347	345	345
Water-quenched 950 deg. C., tempered 700 deg. C. ..	300	309	307	309
Oil-quenched 950 deg. C. ..	542		418	
Air-cooled 950 deg. C.	512		390	
Muffle-cooled 950 deg. C. ..	248		228	

Micro-Examination.—Micro-specimens were prepared from the forged bars, the structure in each case consisting of small particles of carbide set in a pearlite matrix. It was not possible, from the study of these sections, to attach any discernible influence to the presence of beryllium.

(To be continued.)

Notched-Bar Tests of Open-Hearth Steel from Scrap.—H. Wilhelm and L. Jahn, according to a Paper in the "Archiv für das Eisenhüttenwesen," have studied the physical properties of 24 open-hearth steels made entirely from scrap, particularly the results of the notched-bar test on normalised and artificially-aged specimens in relation to the temperature. Over 2,000 specimens were tested and the results found in complete accord with those obtained with steels produced in other ways.

Catalogue Received.

Pulverised-Fuel-Fired Rotary Melting Furnaces.—Messrs. Pittevil & Company, 1, Place du Champs de Mars, Brussels, Belgium, have at long last produced a catalogue dealing with the potentialities of Sesci, but the effort has been well worth waiting for, as it takes a few years to accumulate adequate data for presentation in such a form. We felt quite honoured by the reproduction on page 2 of a leading article we wrote in June last year after participating in the Newcastle Congress and visiting the Close Works of Armstrong-Whitworth. On re-reading it, we can only say like Mr. Joseph Chamberlain: "What we have said, we have said, we withdraw nothing," as the pulverised-fuel-fired rotary furnace has established for itself throughout Europe a permanent position.

The catalogue runs to 24 pages and is excellently illustrated. The paper is buff-coloured, and once again we repeat that this detracts from the value of the microphotographs shown, although it is very suitable for the balance of the matter. The method of presenting the matter is extremely logical, which makes the need for a contents almost, but not quite, unnecessary. Its sections are:—Early History; Description of the Furnace; Types of Coal Used; Method of Operation; Various Technical Data; Pulverisation, Distinguishing Features; Advantages for Grey and Malleable Iron, and for Steel. The last section, "Some Tests," is worthy of starting on a fresh page, as it is somewhat lost in its present position.

An extremely interesting inset is included of a general arrangement drawing of three 10-ton furnaces installed in an Italian steelworks. We were especially interested in the arguments put forward for the use of anthracite coal, based on the combustion of hydrocarbons with the production and decomposition of water vapour, when high-volatile coal or sundry other materials are used, as this theory has made adherents in the field of non-ferrous metallurgy.

In looking over the range of capacities, we were surprised to see that a ½-ton furnace is listed, and it made us wonder just what is the lower economic limit for such furnaces. At the other end of the scale there is the 10-ton furnace, but this we are reasonably certain does not represent finality, and we confidently expect, not so much a furnace to compete with the Siemens open-hearth, but the mixer-type of furnace.

We congratulate the printers on having made an excellent job of the catalogue, and we strongly recommend our readers to procure a copy for immediate perusal and careful filing. By the way, it is possible to procure a copy by writing to the British correspondents of Messrs. Pittevil—Engineers' Agents, Limited, 46, Victoria Street, London, S.W.1—instead of applying to Brussels.

Darlington Rustless Steel & Iron Company.

A petition by Mr. Bernard A. Holland, engineer, of Chelsea, for the compulsory winding up of the Darlington Rustless Steel & Iron Company, Limited, was mentioned to Mr. Justice Maugham in the Chancery Division on October 9.

Mr. Wynn Parry, for the petitioner, said he was a creditor for £3,362 and was supported by another creditor for £1,766. A receiver and manager had been appointed by the bank, and certain creditors opposed the petition.

Mr. Cecil Turner, for the company and creditors for £13,351 and £1,900, opposing the petition, asked for an adjournment to enable the company to put forward a scheme already in draft. The scheme, he said, provided for the issue of debenture stock to the creditors and the bringing in of fresh working capital, which had been secured to a substantial amount. The scheme would be in final form in about a week.

His Lordship granted a fortnight's adjournment.

Low Prices in the Light Castings Trade.

The Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen held its opening meeting of the session on Friday, October 6 at the James Watt Memorial Institute, York House, Great Charles Street, Birmingham. Mr. E. J. Lewis (Messrs. Vowles Bros., Limited, West Bromwich), who succeeds Mr. J. G. Pearce as Branch-President, delivered his address before an encouraging attendance of members, over whom Mr. G. T. Lunt, Senior Vice-President, presided. Before the business started members had an opportunity of inspecting the new centre where in future all meetings will be held. The Institute, which is on the ground floor of York House, has a separate entrance in Great Charles Street, and the meeting room is commodious and in every way well adapted for its purpose.

Per Piece or Per Pound.

Mr. Lewis said he regarded it as an honour to be the first to address the Birmingham Branch in that Institute, erected to the memory of a great engineer. He very much doubted if any of them would occupy their present position in the foundry world but for James Watt. His invention had compelled the production of better castings; but, unfortunately, terribly low prices prevailed, and that was the subject he wished to discuss in his address. Some of them might be interested in the production of better castings; others in the production of larger castings. Personally he was principally interested in the production of castings that would make a profit. The prices being paid to-day for castings were ridiculous, whether they were working in a high-priced metal at so much a pound, or in iron and steel at so much a cwt. He could not speak with first-hand knowledge of the heavy-casting trade, as he had been engaged on light castings for the last fourteen or fifteen years. But from what he was told by friends those in the heavy branch must be hit in exactly the same way, and if the strength of their language was any guide the prices must be very low indeed.

When he lost a big order—and they would agree that a big, running line should be cut to a low figure—he used to think that the more successful competitor had a very clever foundry manager, or that the firm was better equipped to do the job cheaply. When, however, he found that the firm was producing the job by practically the same methods as himself, he came to the conclusion that it was time to stop "hat-lifting" to his competitors, and to find out why they could do it, or, indeed, if they could do it.

Incidence of Overheads.

He mentioned that a few weeks ago he lost a big order which, if they had accepted it, would have involved the works paying the office 9d. a cwt. for the privilege of making it. When they got to that point he thought there was something radically wrong with the industry. It would be said, no doubt, that the vexed question of overheads entered very largely into the question of costs. That was true, but when he informed them that each one of his directors took some individual part in the running of the works he thought he might claim that their overheads were not excessively high. He would give another example. For the last four or five years his firm had quoted for a concern in the motor industry from whom they had never yet received an order. None of the work exceeded 12 to 14 lbs. in weight. The order at issue was a large one. They cut the profit completely out, together with half the overheads, and still lost the order. Why was it? In his opinion they were absolutely in the hands of buyers. He was not blaming the buyers; he was blaming themselves. When a quotation went in, his advice was to let it stand.

Per Piece and Extra Work.

Mr. Lewis commented on the growing practice of quoting per piece, instead of per lb. or per cwt. Fancy getting the drawing of a motor-car crankcase—say the casting weighed 150 lbs.—and having to quote per piece for anything up to 200 or 300 crankcases. Some of the drawings consisted of four sheets, with 16 to 18 sections on them. If they took the drawings into the drawing office and asked for the weight to be figured out, it would take three days to get the weight exactly. But the firm concerned very often wanted the quotation next morning. How many of them engaged in the foundry had time to do this sort of thing? There were doubtless firms who kept a man for the purpose, but what happened when there was no such man? "You put the drawings in your pocket and take them home at night and, with an already tired brain, burn the midnight oil." It might be that the inquiry had been sent to a dozen firms. What an amount of time was wasted over that one inquiry; eleven-twelfths of the time occupied, which might have been spent in productive work, was wasted. But this was not the worst side of quoting to-day. As he had already indicated, they were asked to quote not only per piece but also per pound. What chance had the ordinary foundryman to make a profit on a job under those conditions? Say the casting came out lighter than they anticipated. The purchaser, in that case, did not want it at the price quoted for the article, but at the price per lb. That was all right, but the purchaser ignored the fact that the foundryman's production costs had gone up. It might be said: "It is up to you to work out your weights more accurately." His answer to such critics was: "If you have never done it, have a go at it." It was a large-sized job, after they had done a day's work in the foundry, to take home a bunch of drawings and arrive at an estimate for the work with exactness at a cut-throat figure.

Mechanised Foundries.

Mr. Lewis went on to emphasise that more attention should be given to the human element in the foundry. A great deal of stress was rightly laid on mechanised plant, but when such plant sucked the blood of the worker and signed his death-warrant at thirty or thirty-five years of age he declared it was not mechanised plant, but a thing of the devil. His idea of mechanised plant was that, in the first place, it should lighten the load of labour, and if it did not do so the whole thing was a failure. A few months ago he was in a foundry which had mechanised plant when a friend said to him: "I would sooner be on the dole; in fact, I would sooner be dead." The poor fellows—it was not 10.30 in the morning—were working in trousers and singlets. They were black as ink and the sweat was running out of them, although they were not carrying iron or near any heat. That was called mechanised plant! The plant, in his opinion, should have been so mechanised that it was easy for the men to handle. If he was offered a machine that did not produce a better article at less labour to the men working it he would not instal the machine. It was true that they were sometimes driven by force of circumstances to do things that they did not like, but he earnestly appealed that the milk of human kindness should sometimes overflow in the foundry. His experience was that kindness begot kindness; that when men realised that they were treated with justice they acted justly in return. A satisfied workman turned out about twice as much as a man who was dissatisfied. He would not keep a dissatisfied workman five minutes, because he soon sowed the seeds of rebellion among his mates. Success was only obtainable by straight dealing as between man and man. It was an absolute rule in his foundry that no casting must be "doctored," and the rule was respected. He felt that it was worth the trouble of being a foundry manager if they had the confidence of the men and there was a spirit of mutual trust.

DISCUSSION.

Inviting a discussion, which he understood Mr. Lewis would welcome, the chairman said that compared with some trades it must be admitted that the foundry trade did not make a very generous return to the people in it for the trouble, time, study and knowledge that they had to apply to their daily work.

Mr. F. C. Edwards congratulated the Branch on having such a live President as Mr. Lewis. The foundry manager, he said, must be a practical man, he must be alert and he must think of others.

Mr. J. B. Johnson, as one of the oldest members of the Branch, welcomed Mr. Lewis to the chair. He (Mr. Johnson) had been in charge of a foundry for 18 years, he said, and he claimed to know as much about cut prices as most people. During the past twelve months they had kept the foundry running full time. The bulk of the work had been put into stock, but it was now being absorbed very rapidly. A policy of that sort, if they had the courage to carry it out, paid in the long run. He admitted that in some branches it was impossible to do so, because the castings were so varied that it was impossible to stock them. As to raising prices, in his view the only time when that could be done was when demand was greater than production.

Mr. G. W. Brown advised the President to see a few more mechanised foundries and discover just where mechanisation could be applied with advantage.

Mr. W. J. Molineux suggested that to-day the estimating of prices was a specialist's job. It was a job that should not devolve on the foundry manager. He should not have to take drawings home at night to prepare estimates. Someone whose time was less valuable should do that. He described some foundries in the area as models of inefficiency. While they had foundries going out of business, there were others doing the same class of work, and which were run efficiently, paying 15 per cent. With regard to mechanisation, it could be so introduced as to mean slavery for the men operating some of the machines. On the other hand, there were foundries where the conditions were admirable for the workman, and where the pay, too, was good.

Replying, Mr. Lewis emphasised that he welcomed mechanisation if it meant increased production, lighter labour and more leisure. But if it fell short in these respects he considered it a failure.

The Chairman offered a welcome to Mr. J. W. Gardom, Oliver Stubbs medalist for the present year, and convener of the Technical Committee of the Institute. They were very pleased to see Mr. Gardom, he said, and now that he was resident in the district they hoped he would visit them again.

On the proposition of Mr. F. J. Cook, seconded by Mr. G. M. Callaghan, Mr. Lewis was warmly thanked for his address.

Institute of Metals.—Following its recent Silver Jubilee celebrations, the Institute of Metals has just issued the programme of its activities for the session 1933-34. There will be three general meetings of the Institute—on March 7-8 and in September, at each of which a number of original metallurgical Papers will be presented for discussion, whilst on May 9 the 24th annual May lecture will be delivered. In addition there will be held monthly throughout the coming session meetings of the Institute's six local sections.

Die Casting of Iron and Steel.

RECENT AMERICAN PRACTICE.

In the course of an article in a recent issue of "The Iron Age," Messrs. A. W. Morris and H. R. Simonds point out that early this year an automatic die-casting machine has been put into practical operation in the production of cast-iron camshafts. The so-called permanent moulds in the iron-foundry industry already have achieved some success and high-production semi-automatic operations on casting machines are now established practice in several plants. In this article the distinction between die casting and permanent mould casting essentially is one of pressure. Die-casting machines use permanent moulds, but in addition the molten iron is forced into these moulds under pressure just as in the long-established practice of die casting of the softer metals such as the zinc alloys.

The introduction of a permanent mould machine into the average foundry probably will meet with as much resistance as did the introduction of the moulding machine. However, it seems destined to occupy a prominent place eventually. Great progress is being made in the technique of sand moulding, and elaborate equipment has been devised to reduce to a minimum the number of operations and the efforts of the sand moulders. Stripping plates, vibrators, jolt roll-over machines, and ingenious material-handling devices are some of the principal features. In highly-mechanised sand-casting foundries empty flasks reach the moulder on a roller conveyor from one side, are filled, tamped and stripped by machine, and when complete leave on the same conveyor from the other side whence they pass to the start of a continuous pouring operation.

Production by some such method is often large and efficient, but even at its best, sand-casting technique has many disadvantages. Extensive floor space is required for moulds, moulding machines, sand storage, sand-handling equipment, and sand-reconditioning machines. The cost of handling sand must always be an appreciable item because of the large volume involved. These disadvantages may be grouped under the heading of cost. Other disadvantages may be listed under the heading of quality. The late Dr. Richard Moldenke, one of the greatest authorities on sand moulding, said shortly before his death that one of his strongest desires was "to know how to finish a sand mould so it would peel perfectly." In one of his many tests he made up 42 sand moulds with the best possible coatings, and after the castings had been made he examined their surfaces under a high-powered glass and in all cases was able to see "patches of sand" adhering to the castings. Such sand inclusions are avoided by the permanent mould. The actual grain structure of castings apparently is improved in iron moulds as against sand moulds, and when pressure is added, as in die casting, further improvements are apparent.

Technique of Die Casting.

Die casting of iron differs as much from the usual method of permanent mould casting as the latter differs from sand casting. Die casting of low-melting-point alloys, although a comparatively-recent process, has been in practical operation in this country for nearly 40 years, but it is a big step between the die casting of alloys melting under 1,000 deg. Fah. and those melting at from 2,500 to 3,000 deg. Fah. It was necessary to deviate sharply from the usual non-ferrous die-casting practice, and a description of the design and operation of a large die-casting machine now producing iron camshafts may serve to indicate some of the chief items of departure.

This machine, known as a "Cast-o-matic," is now in commercial operation at a large Pennsylvania manufacturing plant. It was built at a cost of about $25,000. With its "controller" and reservoir ladle it weighs about 27 tons and is about 18 ft. long, 8 ft. wide, and 8 ft. high. Castings weighing from 50 to 250 lbs. and up to 8 ft. long have been successfully produced on it, and the normal capacity is 5 tons of simple castings an hour. Some idea of the size and ruggedness of the casting machine may be had from the fact that for large intricate castings the moulds frequently weigh from 5,000 to 6,000 lbs.

A "controller unit," which may be located at any convenient distance, controls all operations. Briefly, this "controller" is a motor-driven, cam-operated, multiple-valve device having 18 simple and easily-adjustable cams which hydraulically regulate all operations with close accuracy. The actual movement of parts is secured by electric motors and hydraulic cylinders. Metal from a sealed container is forced up (thus "bottom pouring") into the mould at a varying rate of flow, starting slowly and winding up fast, thus intensifying the pressure as the mould is nearly filled, and driving the metal into all corners of the mould. For emergency, and for "setting up" the machine, any or all of these operations may be switched to direct manual operation, or omitted altogether. Provided molten iron of the proper analysis and temperature is delivered so that there is always a supply in the reservoir, and the annealing oven temperature maintained correctly, the process is automatic. With the controller motor running, the operator merely pushes a button and the sequence starts. Sand cores, if they are necessary, are picked up and located in the mould, metal cores are pushed in place, ejector pins are withdrawn to pouring positions, and the two or more parts of the mould are closed. Coincident with these operations, metal from the reservoir fills the pressure chamber to a predetermined level, maintained by means of an automatic scale on which the pressure chamber rests when in free position, and the spout through which the metal is poured is automatically withdrawn.

After all these things have been accomplished the pressure chamber is elevated and clamped tightly against the bottom of the mould. In this position the opening through which the pressure chamber was filled is closed; the plate which closes it has a valve-controlled opening for the introduction of a reducing gas under pressure. This gas is used to force the molten iron up a "nozzle" or gate and into the mould. The pressure varies from 25 lbs. to 250 lbs. per sq. in., depending upon the design of the casting. The moulds are designed with a vertical parting, thus providing ample vents ahead of the rising metal. The bottom pouring holds together the incoming metal, prevents entrapping of air, and greatly reduces oxidation. The point of entrance of metal at the bottom of the mould is cooled by circulating water so as to "trap" the metal at that point as soon as the casting has set under the continuing pressure which feeds the shrinkage.

Soon after the casting has set, reverse operations start. The metal cores are withdrawn, the mould is opened, the casting remover arm is inserted and the ejectors come into action. All this happens within a few seconds. The hot casting is swung around by the remover arm and placed in position in the annealing oven, the doors of which open and close automatically in proper synchronism. Immediately after ejection of the casting and while the mould is wide open, preparation is started for the next casting. The mould is cleaned by strong air pressure and coated with an inert soot. It is then cooled and inspected (by a system of lights and mirrors) and the whole sequence starts over again.

Types of Iron Used.

Not all irons are suitable for die casting even under most favourable conditions. In general, the experience of those who have operated die-casting machines indicates a decided preference for electrically-melted iron. Occasionally experience shows that the analysis must be changed with a variation in type of castings. However, this is not a serious difficulty as castings may be easily grouped according to the iron requirements. Many of the same principles used in sand casting apply to die casting. As in sand casting the temperature at which the metal enters the mould proper should be consistently low, but in die casting the metal should be hot up to the point of entering. Nitridable cast irons are being successfully die cast, but with a higher percentage of rejections. The stainless steels have been handled easily in die-casting operations in laboratory research work, and at least one company contemplates commercial production in this field. Experience indicates that many of the alloys give less trouble than the plain steels, but it is too early to make any generalisation. Table I gives ten different cast irons which have been successfully die cast and which, as a group, will meet almost any condition which the foundryman will encounter.

Table I.—*Cast Irons which will die cast.*

Carbon.	Manganese.	Silicon.	Chromium.	Nickel.	Molybdenum.	Sulphur.	Phosphorus.	Other Alloys.
3.75	1.00	2.50	—	—	—	0.10	0.30	—
3.50	0.80	2.75	—	0.25	—	0.10	0.30	—
2.50	0.50	2.20	—	—	0.30	0.05	0.10	0.15†
2.00	0.60	1.00	0.40	0.85	0.20	0.05	0.05	—
3.50	0.15	0.50	0.50	—	—	0.05	0.05	—
2.75	0.50	2.00	0.20	0.75	0.75	0.10	0.10	—
2.00	0.30	1.75	—	—	—	0.08	0.08	—
2.50	0.70	2.10	0.25	0.25	—	0.10	0.10	—
2.75*	0.15	2.00	—	1.00	0.50	0.05	0.05	0.30††
3.25*	0·70	2.20	—	0.80	0.50	0.05**	0.05**	1.00††

* Will nitride ** Maximum. † Vanadium. †† Aluminium.

The quality of die castings shows the same advantage over sand castings as does any permanent mould productions. Because of the pressure used in die casting, some further advantages are evident. Surfaces are said to be smoother, less tumbling is required, and plating and galvanising are easier. Because of the accuracy possible in die casting, machine work in many cases can be eliminated. Under favourable conditions moulds used in die casting of iron will show a comparatively long life and relatively low cost. The castings should be quickly poured and quickly removed so that the hot metal is in contact with the mould as short a time as possible. In the die casting of camshafts the moulds are cooled with circulating air; in other cases water or oil has been successfully used. The moulds are made up with radiating fins on the back. These are easily cast by using a dry-sand core in which small holes have been drilled.

The best material for moulds has not been definitely determined, although a high-grade alloy is being used for the camshaft moulds. Experience so far indicates that the mould should be designed for bottom pouring and that the parting plane should be vertical. Such parting is better for venting and also is safer for the operator. When metal is forced under pressure into a horizontally parted die, some accident may cause it to squirt out anywhere within 360 deg., but with vertical parting the operator can simply keep out of line of the parting and be safe against accident. In any case use of a shield is good practice.

Mechanisation and the Unemployment Problem.*

By W. T. Kitching.

The subject of this address is associated with the present-day depression in the iron and steel industries and the unemployment problem. This depression and its attendant evil—unemployment—is due, in a large measure, to lack of consumption and over-production by the world as a whole. Under-consumption is due to the inability of the spending public to buy, due to lack of good wages and the substituted "dole." This difficult problem of increasing consumption is taxing the brains of the cleverest men. It is thought that there will always be a vast unemployed population, and that this unemployed population, no matter what conditions are, will always exist.

Every modern plant that is erected, and every plant that is modernised, seeks to cheapen the product by dispensing with labour. In fact, in many cases by employing boy and girl labour as much as possible. Industrialists must include in their estimates for modernising and erecting new plants an item for taxation required to give workers an unemployment allowance, as one must face the fact that the unemployed population *must* have a proper living allowance.

The greatest problem to-day is how to eliminate the misery that comes with leisure and nothing to do. There is no more miserable state in life than having leisure and time on one's hands. It might be wise to study cutting costs from a different angle, that is, by working longer hours with less mechanisation. Far more unhappiness has been caused by having no work to do than by having too much to do.

The present-day labour-saving machinery and mechanisation is going to lead to a state of affairs where half of the population will work full time, or the whole of the population half-time, and the problem is: What are they going to do with these leisure hours? There might be something in a compulsory retiring age of between 50 and 60. A man of 50 and over can absorb leisure time easier than a young man of 30 to 40, but it is a certain fact that there must be a proper retiring allowance provided, enabling these men to live in reasonable retired comfort.

There is very little shortage to-day of necessities in life. The shortage is the inability to purchase by the spending public, and that price maintenance is wrong, and if modern production is not allowed to bring commodities within the reach of everybody, it is certain that there will still be, and always will be, a large unemployed population. Modern production should run on the lines of making commodities so cheap that everybody, no matter what their means, can purchase.

During recent years a good deal of progress has been made in the manufacture of articles by various methods, and some of these methods have been extended to cover many types of articles formerly made exclusively in the foundry as castings. For example, castings for turbines, and other electric gear, and similar articles, are fabricated from rolled material joined by welding. Drop forgings are now manufactured in shapes which at one time were considered suitable only for being cast in the foundry. Recently die casting of iron and steel has been accomplished, and although as a process it still presents many technical difficulties, there is no doubt that it will steadily progress, and will supply some articles now made in the ordinary foundry. The manufacture of decorative and useful articles in plastic materials of bakelite and other types, has made considerable strides during recent years, and the advocates of this type of material predict for it a very rosy future. There is no doubt that a good many articles previously manufactured as metallic castings can be satisfactorily made in these plastic materials, and their appearance can be made very attractive, but still there is further scope in the foundry to-day for other articles in cast iron. Railings and gates for household property were at one time made in cast iron, but with the advent of cheap rolled steel, railings were made in rolled material, either welded or riveted. There is no reason why railings should not be made again in cast iron by modernised and mechanised plants as cheaply as fabrication in steel.

It would be quite useless for the members of the foundry industry to sit down and wail about these or any other inroads into what has hitherto been the preserve of the foundry. Whenever new methods of manufacture arise, they are always tried over a very wide sphere, in some parts of which they are found unsatisfactory, and after a time they settle down to occupy a more or less well-defined place in the industrial scheme, without much interference from the other industries. One should rather admire the enterprise of those connected with these newer industries in endeavouring to extend their activities. The only thing for the foundry trade to do is to emulate their example and try to find articles now manufactured by other processes which could be made as good, and at a lower cost, as castings. For example, in America cast-steel crankshafts have been recently made, and appear to be giving reasonable service. Where the surface of a metal article is exposed to corroding influences, castings have recently been made with a surface of resistant metal. This is naturally a good deal cheaper than making a solid piece of metal of, say, stainless steel. This aspect of foundry work will probably increase in importance when the details of procedure are standardised, and regular success can be guaranteed. There are no doubt plenty of other spheres in which castings could be used, and it is for those engaged in the foundry industry to find these, and so extend their range of activities. For instance, there is a future for road paving by cast-iron sets. The Stanton Iron Company is paving the Mersey Tunnel with cast iron. Road paving in cast iron has many advantages, and it has been found in the Mersey Tunnel that there is less noise from the wheels of vehicles running over cast iron than any other material. Also the risk of bituminous material burning in the case of fire is practically eliminated.

The mechanisation of foundries is increasing. For repetition work, where large quantities of similar castings are concerned, mechanisation can produce a standard article at a low cost.

There will always, however, be cases where only one casting or only a few are required of a particular kind; for example, in replacements an order frequently consists of one casting only. Similarly, in the construction of heavy presses and other similar articles, which are made either singly or only in small numbers, castings must be made individually. There will, therefore, always be a demand for some foundries of the jobbing type. In these, the skill of the individual foundry worker, moulder and other foundry operatives, is very necessary, so that there should be no danger of the manipulative skill and the pride in craftsmanship, so characteristic of the older generations of foundry workers, being completely lost to posterity as has frequently been suggested.

Everybody is looking forward with great interest to the result of Prof. Andrew's inauguration of a foundry course at the Sheffield University. There is tremendous scope for the highly skilled and energetic foundry worker, and all foundry managers will agree that it is always difficult to find the right class of highly skilled labour, and, combined with technical knowledge, there is considerable scope for this class of man.

* Given as a Presidential Address to the Sheffield Branch of the Institute of British Foundrymen.

Sand Control on a Continuous Moulding Unit in a Malleable Foundry.

(*Concluded from page* 216.)

Fig. 2 shows the effect of using too coarse a sand for open cores, with the result that the system sand has a poor grain distribution and the castings an unsatisfactory finish. Either the core mixtures must be regulated to produce a fine system sand or facing will have to be used. The use of the latter is very expensive, and considerable expenditure can be made in the selection of the proper core sands.

The amount of core binder used and the method of baking determine the manner in which cores disintegrate at the shakeout. It is desirable that sufficient core sand be liberated to the system to replace sand lost by adherence to the castings, otherwise the control of the moulding sand becomes difficult. It is apparent that control of the core sand is of equal importance with control of moulding sand, but it is not the purpose of this Paper to deal with core sand to any extent. Suffice it to say that the best co-operation possible between the moulding department, core department and sand laboratory is essential to the production of a satisfactory moulding sand.

Foundry Scrap.

The many foundry troubles directly or indirectly traceable to faulty sand are well known to every foundryman. Broken moulds, drops, misruns, cold shuts, scabs, blows, dirty moulding, rough castings, etc., often are the result of improper sand. The broken moulds that can be caused by incorrect moisture content in the sand can be so high in one hour that the entire day's efficiency is destroyed.

At times, sand is unjustly blamed for certain foundry difficulties. Improper jolting, ramming and squeezing, poor design of squeeze heads, fluctuating air pressures, gradual wear on moulding machines, etc., result in troubles too often blamed on the sand. In the final analysis, the condition of the sand in the mould, not the laboratory tests, is the criterion of its fitness. It avails nothing if the sand is perfect yet not made into the mould the same each time.

All complaints about the sand should be quickly investigated and the blame properly placed. The sand laboratory can be of much assistance to the moulding department in so far as it can help to work out problems pertaining to the use of the sand. The laboratory should take a conciliatory attitude toward the moulding department—much the same attitude as the salesman takes toward the user of his product.

Influence of Moulding Sand on the Product.

Many small jobs are used in connection with mass production, and it is necessary that they be definitely true to size. In the operations of straightening and machining, the castings must fit jigs perfectly, otherwise operation is slow. Faulty sand will cause pimples and fins at the parting line, rough spots, etc., which prevent the castings from precessing properly. The amount of salvage grinding will be reduced with good smooth castings.

The sand should be of such nature that the castings will clean readily. Where castings are not milled in the hard iron and too much sand adheres to them, inspection is hampered, scrap is annealed and processed and considerable sand enters the anneal, which wastes fuel and upsets the annealing cycle. Moreover, excessive amounts of sand adhering to the castings after the shakeout cause slow cooling of the iron and difficult annealing. The finish on the casting should be the best that can be obtained, as it makes for pride in the product and ensures the customer's good will.

In conclusion, it is desired to emphasise the fact that the control of sand is of major importance in the successful operation of a modern foundry.

This Week's News in Brief.

Trade Talk.

The Zinc Manufacturing Company, Limited, have removed their registered and transfer offices to 12a, Charterhouse Square, London, E.C.1.

Messrs. Charles Ross, Limited, have completed at their Aizlewood Road Works, Sheffield, a locomotive weighbridge of a capacity of 168 tons for the Indian State Railways.

South Wales has received its first cargo of Newfoundland iron ore in connection with the recent barter transaction, under which Welsh coal will be exchanged for Newfoundland ore.

Orders for 247 railway wagons have been placed in Great Britain by the Nizam of Hyderabad's State Railways, which during the past year have placed orders for rolling-stock in this country to the value of £250,000.

Messrs. Gent & Company, Limited, manufacturing electrical engineers, of Leicester, announce that their branch office at Newcastle has been transferred from Blackett Street to Tangent House, Leazes Park Road, Newcastle-upon-Tyne, 2.

Messrs. James Adam & Sons, Limited, Gourock, have received an order to build a 40-ft. auxiliary motor cruiser. The vessel will be constructed to the designs of Mr. W. G. McBryde, naval architect, Glasgow, and fitted with Gleniffer oil engines.

Official returns to the Electricity Commissioners for September show that 1,023,000,000 units of electricity were generated by authorised undertakers in Great Britain during the month, representing an increase of 10.8 per cent. as compared with September, 1932.

Cochranes (Middlesbrough), Limited, manufacturers of cast-iron and centrifugally-made iron pipes, have opened an office in London at 11, Arundel Street, Strand, W.C.2, and have appointed Mr. E. M. Gill to be sales representative in London and the South.

Additional work is assured for Bo'ness shipbreakers by the arrival at the Bridgeness Shipbreaking Yard of the s.s. "Mississippi." Built at Govan by Messrs. Harland & Wolff, Limited, in 1914, the "Mississippi" will be broken up in the company of her sister ships, "Maryland" and "Missouri."

It is the custom of Messrs. Glenfield & Kennedy, Limited, Kilmarnock, to present a gold medal to each of their members of staff and employees on the attainment of 50 years' continuous service with the firm. Mr. W. W. Muir, buyer, is the latest member who has qualified for this distinction, bringing the number of medals presented during the last four years up to 26.

Special interest attaches to the trials which have been in progress on the Clyde during the week of the new motor-ship "Malaita," built by Messrs. Barclay Curle & Company, Limited, Glasgow, for Messrs. Burns Philp & Company, Sydney. The vessel has been fitted by Messrs. J. G. Kincaid & Company, Limited, Greenock, with the first two-stroke single-acting Burmeister & Wain Diesel engine constructed in Great Britain.

The first launch to take place in Belfast since April, 1932, was made by Messrs. Workman Clark (1928), Limited, when they put into the water the "Isipingo," the first of three motor-ships being constructed for Messrs. Andrew Weir & Company, Limited, London. The vessel has been specially designed for passenger, mail and cargo services between India and South African ports. The propelling machinery constructed by the builders consists of two sets of Workman Clark Sulzer Diesel engines of sufficient power to give the vessel a speed of 15 knots.

There was an encouraging attendance at the club-room at Mungal Foundry on the occasion of the first of a fortnightly series of entertainments arranged under the auspices of the Carron Works Recreation Club to be held during the winter months. Mr. H. Metcalfe, President of the Club, occupied the chair, and in his introductory remarks made reference to the activities of the Club, which that evening entered upon the fourteenth year of its existence. The various sections, in spite of some changes in personnel and readjustments, were now good going concerns, and they had their own orchestra of 28 instruments to entertain them. A vocal and orchestral programme under the direction of Mr. W. Penman was greatly appreciated by the large audience.

Preparations are well advanced for the establishment of a new industry in Sheffield, within the works of Hadfields, Limited. A new company has been formed under the style of Millspaugh, Limited, at the head of which is Mr. W. H. Millspaugh, who for many years carried on at Sandusky, Ohio, the manufacture of paper-making and other machinery. The American business has been sold, and Mr. Millspaugh now intends to supply the British and oversea markets with his products from Hadfields' works. He will utilise the facilities of the Sheffield works and is putting down in a building adjoining Hadfields' foundry a plant to make the largest bronze tubular castings required in the production of paper-making machinery and in the shipbuilding and engineering industries. The new concern expects to supply the copper bronze and steel engraving rolls to the textile and printing trades. Casting machinery for all metals is being installed within Hadfields' open-hearth steel plant, and a large bronze foundry is being erected in a building adjoining the steel plant.

Messrs. Glenfield & Kennedy, Limited, Kilmarnock, have received an order for over 100 large sluices for the first section of the sewage purification works now in course of construction by the West Middlesex County Council. The contract will provide work for many months to come, and represents the first quarter of probably the largest scheme of its kind in the world. The sluices will all be electrically operated with distant control and indication, incorporating the latest refinements in this class of equipment which have been developed as a result of the firm's experience in the control of water. In addition to this order, the contracts for most of the water-control equipments on the three major hydro-electric schemes (Galloway, Grampian and Lochaber) at present being carried out in Scotland have all been placed with Messrs. Glenfield & Kennedy, Limited. The firm has also several important contracts on hand for large valves abroad, the most important of which is for four large units which are being supplied to a large French hydro-electric scheme.

Contracts Open.

Belfast, October 23.—Supply and erection of 15-ton weighbridge, Lagonbank Road, for the Corporation. The City Surveyor (Room 83), City Hall, Belfast.

Calcutta, October 31.—Reverberatory furnace, semi-tilting, for non-ferrous metals, 1 ton or 10 cwts., for the Eastern Bengal Railway. The Director-General, India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

Farnham, October 21.—70 cast-iron hexagonal lamp columns, complete, for the Urban District Council. Mr. L. H. Starling, engineer and surveyor, Council Offices Annexe, Farnham, Surrey.

Welwyn Garden City, October 31.—Cast-iron lamp columns, for the Urban District Council. Mr. W. E. James, surveyor, Council Offices, Bridge Road, Welwyn Garden City, Herts. (Fee £1 1s., returnable.)

New Companies.

Edward Foster & Son (Bradford), Limited.—Brassfounders, etc. Capital £1,500. Directors: L. Foster, 49, Clapton Avenue, Halifax; A. K. Dawson.

Brymbo Steel (Successors) Company, Limited.—Iron smelters, manufacturers of iron and steel, etc. Capital £100. Subscribers: Sir Henry B. Robertson, Pale, Llandderfel, Merioneth; H. Robertson and D. Robertson.

Company Reports.

Babcock & Wilcox, Limited.—Interim dividend on ordinary shares of 3 per cent., less tax.

Steel Company of Canada, Limited.—Third quarterly dividend of 30 cents per share on the common stock.

Tube Investments, Limited.—Dividend of 8 per cent. on the ordinary shares for the year ending October 31, and at the relative rate on the liaison ordinary shares.

Personal.

Mr. J. A. Darby has been appointed sales manager of Messrs. Herbert Terry & Sons, Limited, spring manufacturers, of Redditch.

Mr. Robert Simpson, of Glengarnock Steel Works drawing office, was recently made the recipient of a dressing table by Mr. J. Thorburn, works manager, on behalf of his colleagues, to mark the occasion of his wedding.

Mr. John Patrick, of the bar department of Messrs. Colville's Dalzell Steel Works, was presented recently with a handsome walnut display cabinet and a mirror from the directors and staff to mark the occasion of his marriage.

Mr. Walter Sheldon Tower has been appointed secretary of the American Iron and Steel Institute. Mr. Tower has been manager of commercial research for the Bethlehem Steel Company for the past nine years. He was commercial attaché to the American Embassy in London from October, 1921, to November, 1924.

Mr. W. E. Baker and Mr. A. W. Peck have been elected directors of Messrs. Charles Hill & Sons, Limited, shipbuilders and ironfounders, of Bristol. Mr. Baker started his business career with the company, and has been secretary since 1919. Mr. Peck has been naval architect to the company since 1918.

Mr. P. H. Mills, who has been appointed to succeed the late Sir Gilbert Vyle as managing director of Messrs. W. & T. Avery, Limited, of Soho Foundry, Birmingham, received his early training in the well-known firm of W. B. Peat & Company. He joined Messrs. W. & T. Avery, Limited, in 1919, and the work he did was recognised by his appointment as general manager in 1924. Noticeable features of his management were the modernisation of the products and manufacturing facilities of this old-established company. Mr. Mills joined the Avery board of directors in 1927.

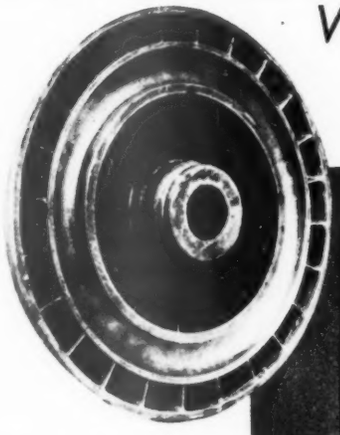
Obituary.

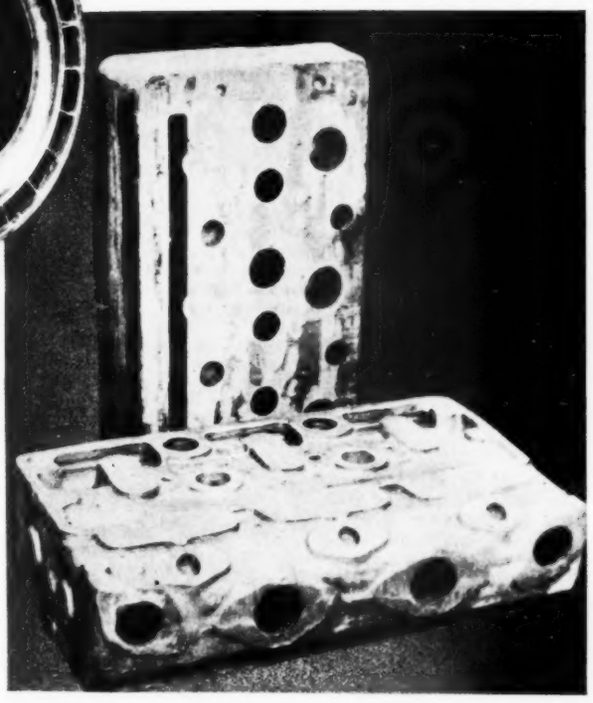
Mr. John C. Wright, a prominent figure in the Scottish light-castings industry, died on Saturday at the age of 65. A native of Denny, Mr. Wright, as a boy, entered the service of his uncle, Mr. James Wright, of Gogarfield, Denny, who was then sole partner of the firm owning Burnbank Foundry, Bainsford, Falkirk, and he was connected with the business all his life, having been for a number of years head of the company operating this important foundry.

The death occurred at his home in Denny, on October 10, of Mr. Thos. Henderson, who until he retired about six years ago on account of failing eyesight, was connected all his working life with the light-castings industry. Mr. Henderson was born in Dennyloanhead 66 years ago, and after completing his apprenticeship with Messrs. Cruikshanks & Company, Limited, Denny Iron Works, worked for some time in Greenock and Paisley, returning to Denny in 1900.

The premises of the Scottish Enamelling Company, Limited, Larbert, were the scene of a distressing fatality by electrocution, the victim being a well-known Camelon man, Mr. William Gibson Richmond, an assistant foreman with the firm. From what can be gathered, the man went on duty at 11 p.m., and it appears that he endeavoured to insert a plug into a lighting circuit after having switched on the current, while holding the iron door handle. Death apparently was instantaneous.

Inverse Chill in Grey Cast Iron.—In Mr. J. G. Pearce's discussion on Mr. Kain's paper published on page 203 of our issue of October 12, the reference to Mr. Kain's "Fig. 5" in the paragraphs numbered 1 and 3 should read "Fig. 4."





Top: Driving member of the Salerni fluid flywheel coupling, in Hiduminium R.R. alloy. The approximate diameter is 18" and the weight 15 lbs.

Lower: Cylinder head for A.E.C. high-speed oil engine, also in Hiduminium R.R. alloy. The size is 18¼" × 10⅛" × 4¼", and the weight 38 lbs.

(Both pictures by courtesy of HIGH DUTY ALLOYS, Ltd., Slough, Bucks.)

Whether for

HIGH THERMAL EFFICIENCY *or* **LIGHTNESS** *and* **STRENGTH**

Owing to a heat conductivity three times that of cast iron, with the aluminium alloy cylinder head, compression ratios can be raised without any trace of detonation. The whole combustion space keeps cooler, valves and plugs are cooler, and there is a steady sustained pull on long inclines, all due to the high thermal conductivity of aluminium alloys. In the case of such castings as flywheel couplings, aluminium alloy provides a light and strong metal.

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THE BRITISH ALUMINIUM Co LTD.
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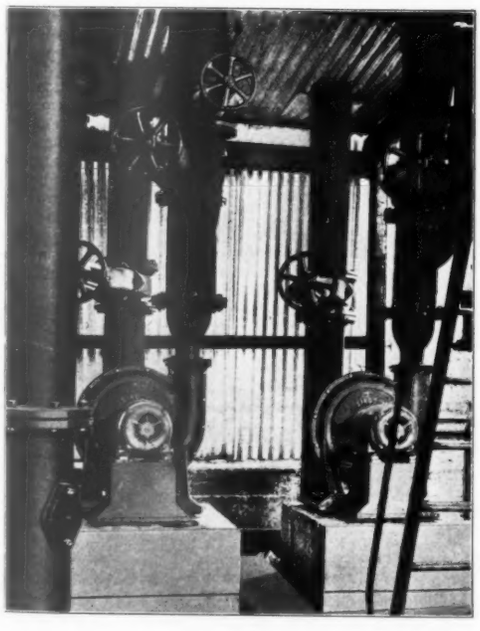
Newcastle.....Milburn House.
Glasgow .....113, West Regent Street.

F.T.J. 19.10.33.

A NEW TRADE SIROCCO MARK *CATALOGUE!*



No. S.F. 26 dealing with "Sirocco" Fan Manufactures for moderate and high pressures. It includes some interesting examples of recent installations and contains detailed and accurate information concerning duties, weights and dimensions for the wide range of sizes and designs listed. In addition, numerous tables assist in determining the most suitable "Sirocco" Fan Equipment for use under diverse operating conditions.

A copy for reference is indispensable.

Write to

DAVIDSON & CO., LIMITED,

SIROCCO ENGINEERING WORKS, BELFAST.

LONDON : MANCHESTER : NEWCASTLE : BIRMINGHAM : CARDIFF : BRISTOL : GLASGOW : DUBLIN

Raw Material Markets.

The demand for iron and steel materials in general continues to record a steady expansion. This applies particularly to pig-iron, for which there is a strong demand, as there are fears of higher prices. Already, coke and ore prices are showing a much stronger tendency. There continues to be an expansion in the output of steel, last month's production being the highest since June, 1930.

Pig-Iron.

MIDDLESBROUGH.—There is still an active demand for Cleveland foundry iron, in spite of the recent heavy buying, but the makers are not able to take on many fresh commitments before the end of the year at the present rate of production. There is certainly ample reason for the restarting of a furnace on foundry grade, as local consumption is steadily expanding, as are also shipments to Scottish ports. In these circumstances, local producers are not pressing for export business. The official prices in the case of No. 3 Cleveland G.M.B. pig-iron are 62s. 6d. delivered Middlesbrough, 64s. 6d. delivered North-East Coast, 62s. 3d. delivered Falkirk, and 65s. 3d. delivered Glasgow. One shilling per ton discount is allowed on No. 4 foundry and No. 4 forge iron, and No. 1 foundry is at a premium of 2s. 6d. per ton.

The East Coast hematite market has a very strong tone. The makers are heavily sold, and are cutting into their stocks to make up heavy deliveries to Sheffield, the Midlands and South Wales. The works' f.o.t. or f.o.b. quotation for mixed numbers remains at 60s. per ton, at which level consumers have shown anxiety to buy. No. 1 quality is at 6d. per ton premium.

LANCASHIRE.—The light-castings trade continues to be fairly well occupied, and the same may be said of the textile machinists, but activity at the jobbing foundries does not show much improvement. The pig-iron market is not very active just now. The general price position is firm, with offers of Derbyshire, Staffordshire and Cleveland brands of No. 3 for delivery to users in the Manchester zone quoted on the basis of 67s. per ton, Northants at 65s. 6d., Derbyshire forge at 62s., Scottish foundry at 80s., East Coast hematite at up to 75s., and West Coast at 80s. 6d.

MIDLANDS.—The majority of furnaces in the Midlands are reported to be sending out more iron than they are making. Conditions in the consuming industry continue to be satisfactory. Not a great deal of new business is being put through, as many consumers have covered their supplies ahead for the next three or six months. There are no changes in the prices of foundry iron. Northamptonshire No. 3 is at 62s. 6d., and 66s. is the price for Derbyshire, Lincolnshire and North Staffordshire No. 3, delivered to Birmingham and Black Country stations, and subject to rebate for big consumers. Continental foundry iron is not competitive, and only small supplies of Cleveland brands are being offered. There is no diminution in the call for special irons for individual trades. Prices vary a great deal, according to quality. Scottish No. 3 is at 85s. per ton, and other medium-phosphorus grades are offered at between 70s. and 80s., with low-phosphorus grades 80s. to 90s. per ton. Quotations for special refined iron for cylinder work, etc., vary from £5 to £6 15s. per ton.

SCOTLAND.—Scottish foundry is in poor demand, work remaining scarce at the heavy engineering foundries. Some of the light-castings firms are well employed and good deliveries of English iron are being taken. Scottish No. 3 foundry is still quoted at 65s. f.o.t. furnaces, with 2s. 6d. extra for No. 1. There has been no change in the official prices of 62s. 3d for No. 3 Cleveland f.o.t. Falkirk area and 65s. 3d. f.o.t. Glasgow. No. 3 Lincolnshire and Northamptonshire irons are 1s. 3d. to 2s. 3d. per ton less.

Coke.

There has been no change in foundry-coke prices, but there is a firmer tone, in view of the increase in furnace-coke quotations, and founders are taking the opportunity to cover forward. Present prices for delivery in the South Staffordshire area are :—Best Durham coke, 36s. to 38s. per ton; Welsh coke, 30s. to 45s., according to quality; Scottish low-ash coke, 38s. 6d. to 40s. per ton.

Steel.

The steady expansion of business in the iron and steel trades of the past few months has been interrupted by a slight falling off in activity; but this is regarded as being only a temporary lull, says the weekly report of the London Iron and Steel Exchange. The undertone of the market for nearly all steel materials is firm, and the prices of some descriptions show a tendency to advance. The active demand for semi-finished steel remains a feature. In the finished-steel market business is rather irregular. The poorness of the demand from the shipyards is a disappointing feature.

Scrap.

Firm conditions continue to characterise the Cleveland scrap-iron market and prices still have an upward tendency, in view of the growing shortness of supplies. The Midlands market is firm, the founders being busy and taking good supplies, although there has been no change in prices. There is a more active demand in South Wales for heavy cast iron, but good cast-iron machinery scrap for foundries is still quiet. In Scotland there is not such a good demand for scrap iron as for steel material, as few of the foundries are really busy.

Metals.

Copper.—After displaying weakness last week, standard quotations improved on Monday to £33 16s. 3d. per ton, electro rising to £37 per ton. Slightly more support has been forthcoming from consumers, whose abstinence from the market last week, in combination with a reduction in their export prices by the Customs smelters, was largely responsible for the decline in prices. The demand for manufactured copper products fails to show the improvement looked for, particularly as regards this country. The American situation continues to attract interest, but the position still remains very obscure. At all events, it can be seen that little progress has been made so far with the "codification" of the copper industry, it being difficult to reconcile the interests of the Custom smelters and of the producing-refining groups. The domestic demand for copper in the United States is only fair, but may be stimulated by N.R.A. public works schemes.

The week's prices have been as follow :—

Cash.—Thursday, £33 2s. 6d. to £33 3s. 9d.; Friday, £33 6s. 3d. to £33 7s. 6d.; Monday, £33 16s. 3d. to £33 17s. 6d.; Tuesday, £33 3s. 9d. to £33 5s.; Wednesday, £33 3s. 9d. to £33 5s.

Three Months.—Thursday, £33 6s. 3d. to £33 7s. 6d.; Friday, £33 10s. to £33 11s. 3d.; Monday, £33 18s. 9d. to £34; Tuesday, £33 6s. 3d. to £33 7s. 6d.; Wednesday, £33 7s. 6d. to £33 8s. 9d.

Tin.—Quotations on the London Metal Exchange have not shown a very firm tone following the recent developments with regard to international control. The new arrangement between the producing countries makes some minor adjustments in national quotas. What is more important, it is generally expected that, at the next meeting of the International Tin Committee, to be held towards the end of the month, an increase in the general production quota will be made, from the present 33⅓ per cent. of capacity to about 40 per cent., to take effect from the beginning of 1934. Such a step is urgently necessary for, under present conditions, a serious shortage of supplies is quite feasible. U.S. tin-plate mills are still working at high pressure, although there are labour troubles at one of the largest works.

Daily quotations :—

Cash.—Thursday, £223 15s. to £224; Friday, £223 17s. 6d. to £224; Monday, £222 15s. to £222 17s. 6d.; Tuesday, £221 17s. 6d. to £222; Wednesday, £224 to £224 2s. 6d.

Three Months. — Thursday, £223 15s. to £223 17s. 6d.; Friday, £223 15s. to £224; Monday, £222 15s. to £222 17s. 6d.; Tuesday, £221 17s. 6d. to £222; Wednesday, £223 17s. 6d. to £224.

Spelter.—Prices in the spelter market are now slightly steadier, following the recent liquidation. Cartel stocks increased slightly last month, as compared with August, in conjunction with a slightly larger output. In their weekly report, Messrs. Brandeis, Goldschmidt state that the figures which have been published in the United States of America show that the stocks in that country have again declined by over 2,000 short tons, and are now below the 100,000 tons mark. It might have been expected that the general weakness in commodities—particularly in copper—would have influenced the price, but this has been fairly firm. The European market has, however, been rather weaker, although the contango on the London market has again become more normal. The demand from the galvanising trade in this country is improving, but the position on the Continent is not yet satisfactory.

Price fluctuations :—

Ordinary.—Thursday, £16 10s.; Friday, £16 10s.; Monday, £16 11s. 3d.; Tuesday, £16 8s. 9d.; Wednesday, £16 6s. 3d.

Lead.—This market continues to be very dull, report Messrs. Henry Gardner. The metal undoubtedly deserves more support, as with no restriction of an organised kind the effect of low prices has had full play. Consumption is greater than production, and stocks are on the decline from purely economic causes. The pipe and sheet manufacturers remain quite active, but this is offset by the comparative slackness of cablemakers.

Daily market prices :—

Soft Foreign (Prompt).—Thursday, £11 17s. 6d.; Friday, £11 17s. 6d.; Monday, £11 17s. 6d.; Tuesday, £11 13s. 9d.; Wednesday, £11 13s. 9d.

Iron and Steel Output in September.

The National Federation of Iron and Steel Manufacturers state that there were 74 furnaces in blast at the end of September, a net increase of one since the beginning of the month, two furnaces having been blown in and one having ceased operations during the month. The production of pig-iron in September amounted to 359,700 tons compared with 362,700 tons in August (a slightly increased daily rate), and 260,400 tons in September, 1932. The production includes 118,400 tons of hematite, 150,600 tons of basic, 75,200 tons of foundry and 8,100 tons of forge pig-iron. The output of steel ingots and castings in September amounted to 669,000 tons compared with 551,300 tons in August and 430,300 tons in September, 1932.

Scottish Steel Trade More Active.—The improvement in the steel industry in Lanarkshire continues satisfactorily. It is reported that most of the big firms have booked new orders and more are anticipated in view of the Clyde shipyards showing signs of improvement. During the past six weeks the Clydesdale works of Messrs. Stewarts and Lloyds have been on the three-shift system and a number of additional young men are being taken on. Trade conditions have improved steadily at the Blochairn works of the Steel Company of Scotland, Limited, during past months, and a number of extra men have been restarted to cope with new orders. The Steel Company of Scotland, Limited, has paid to its workers a bonus which amounts in some cases to the wage "cuts" suffered by the workmen in previous years. A bonus has been paid to all workmen in Blochairn works who earn more than 50s. per week. Workmen who received wages under that figure were not called upon to suffer any "cut." Varying amounts have also been paid to members of the office staff both at Blochairn works and the head office of the company in Glasgow. It is understood, however, that though in some cases the bonus paid by the company was equal to the amount of the wage cut, it is not to be considered as restoring future wages to their former level. The payment is definitely a voluntary bonus which the company feels in a position to make to their employees in view of the industrial situation.

FOR SCOTTISH IRONFOUNDERS.
FOUNDRY COKE
SPLINT COAL
SMITHY COAL
also
Hard Firewood for Kindling Purposes
(in cut lengths 2′ to 3′) for Furnaces.
FOR QUOTATIONS—
Estab. 1870. JOHN KNOX & Co., Telephone: Doug. 3506
Pinkston, Port Dundas, GLASGOW, C.4.

£1,200 SAVING PER ANNUM

by using MOLTEN METAL PYROMETERS

Thermocouple.

Indicator.
8 × 8 by 5 inches.
Weight 10½ lbs.

This considerable saving in cost was found by one manufacturer to result from the use of Pyrometers to determine the pot temperatures immediately before pouring. Spoiled castings can by this means be greatly reduced. The Cambridge Portable Outfit illustrated is giving similar results in many foundries all over the word.

Full details are given in LIST 194-F sent free on request.

CAMBRIDGE
INSTRUMENT Co Ltd

WORKS:- LONDON & CAMBRIDGE
Head Office & Showrooms:- 45, GROSVENOR PLACE LONDON S.W.1

12.

Complete and instantaneous control of flame conditions by the Buell System of P. F. Firing will effect these economies in your plant.....

Progress!

28 Metallurgical Furnaces now being fired with the Buell System.

THE ease with which the Buell System of pulverised fuel firing can be adapted to existing furnaces and the exceptional economies and finer quality of the production are the results of much intensive research into the needs of the metallurgical industry.

Cheaper fuel can be burned, and the number of men required for controlling combustion is reduced in the majority of instances to less than one half of the number required for hand firing.

The great flexibility and accurate control of heating conditions not only increases quality of production but eliminates stand-by losses which frequently assume large proportions in normal practice.

You can definitely rely on attaining these results :—

1. ***GREATER HEAT FROM POORER QUALITY FUEL.***
2. ***REDUCTION IN LABOUR.***
3. ***REDUCTION IN TIME CYCLE OF OPERATIONS.***
4. ***ALMOST COMPLETE ELIMINATION OF SCALING OF PRODUCTS AND EQUAL HEAT DISTRIBUTION THROUGHOUT THE FURNACE.***

The Buell Combustion Co Ltd
49, MOORGATE, LONDON, E.C.2
TELEPHONE: METROPOLITAN 7751.
Works: EDGAR ALLEN & CO., LTD., Imperial Steel Works, Sheffield.

XUM

RAW MATERIALS—PRICE LIST.

(Wednesday, October 18, 1933.)

COPPER.

	£	s.	d.
Standard cash	33	3	9
Three months	33	7	6
Electrolytic	36	10	0
Tough	35	0	0
Best selected	35	10	0
Sheets	64	0	0
India	45	0	0
Wire bars	37	10	0
Ingot bars	37	10	0
H.C. wire rods	39	5	0
Off. av. cash, September	35	3	7 3/4
Do., 3 mths., September	35	7	3 9/16
Do., Sttlmnt., September	35	3	8 1/8
Do., Electro, September	38	13	10 3/8
Do., B.S., September	38	3	7 1/8
Do., wire bars, September	39	0	11 7/8
Solid drawn tubes			10½d.
Brazed tubes			10½d.
Wire			7d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	8⅝d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	7⅝d.
Wire	7⅝d.
Rolled metal	7¼d.
Yellow metal rods	4¾d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN.

	£	s.	d.
Standard cash	224	0	0
Three months	223	17	6
English	224	10	0
Bars	226	0	0
Straits	230	0	0
Australian (nom.)	—		
Eastern	229	10	0
Banca	229	0	0
Off. av. cash, September	216	19	3 3/7
Do., 3 mths., September	216	18	4 4/7
Do., Sttlmt., September	216	19	0 3/7

SPELTER.

	£	s.	d.
Ordinary	16	6	3
Remelted	16	0	0
Hard	14	0	0
Electro 99.9	19	0	0
English	17	5	0
India	16	0	0
Zinc dust	20	0	0
Zinc ashes	3	10	0
Off. aver., September	16	18	6 1/7
Aver. spot, September	16	16	2 2/7

LEAD.

	£	s.	d.
Soft foreign ppt.	11	13	9
Empire	11	18	9
English	13	5	0
Off. average, September	12	1	7 3/4
Average spot, September	11	18	7 1/2

ALUMINIUM.

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	25	15	0
Do., V.M. ex whse.	25	5	0
Rods	30	10	0

ANTIMONY.

	£	s.	d.		£	s.	d.
English	37	10	0	to 40	0	0	
Chinese, ex-whse.	26	15	0				
Crude	20	10	0				

QUICKSILVER.

	£	s.	d.		£	s.	d.
Quicksilver	9	10	0	to 10	0	0	

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£6 10 0
45/50%	£12 10 0
75%	£18 2 6
Ferro-vanadium—	
35 50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free of Mo.	5/6 per lb.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	2/4 lb.
Tungsten metal powder—	
98/99%	2/7 lb.
Ferro-chrome—	
2/4% car.	£25 10 0
4/6% car.	£21 17 6
6/8% car.	£19 7 6
8/10% car.	£18 17 6
Ferro-chrome—	
Max. 2% car.	£29 15 0
Max. 1% car.	£30 17 6
Max. 0.70% car.	£35 15 0
70%, carbon-free	9½d. lb.
Nickel—99.5/100%	£225 to £230
"F" nickel shot	£202 10 0
Ferro-cobalt, 98/99%	5/6 lb.
Metallic chromium—	
96/98%	2/8 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel					2	10	0
Bundled steel and shrngs.	1	17	6	to 2	9	0	
Mixed iron and steel	2	5	0	to 2	6	6	
Heavy cast iron	2	5	0	to 2	7	6	
Good machinery	2	7	6	to 2	10	0	
Cleveland—							
Heavy steel					2	7	6
Steel turnings					1	11	6
Cast-iron borings					1	2	0
Heavy forge					2	10	0
W.I. piling scrap					2	5	0
Cast-iron scrap	2	5	0	to 2	7	6	
Midlands—							
Light cast-iron scrap					2	0	0
Heavy wrought iron					2	10	0
Steel turnings, f.o.r.	1	6	6	to 1	7	6	
Scotland—							
Heavy steel					2	7	6
Ordinary cast iron	2	6	0	to 2	7	6	
Engineers' turnings					1	14	0
Cast-iron borings					1	15	0
Wrought-iron piling	2	8	6	to 2	10	0	
Heavy machinery	2	10	0	to 2	11	6	

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	29	0	0
Brass	19	0	0
Lead (less usual draft)	10	15	0
Tea lead	8	5	0
Zinc	11	0	0
New aluminium cuttings	73	0	0
Braziery copper	26	0	0
Gunmetal	25	0	0
Hollow pewter	137	0	0
Shaped black pewter	100	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	65/-
Foundry No. 3	62/6
,, at Falkirk	62/3
,, at Glasgow	65/3
Foundry No. 4	61/6
Forge No. 4	61/6
Hematite No. 1, f.o.t.	60/6
Hematite M/Nos., f.o.t.	60/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	68/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	62/-
,, No. 3 fdry.	66/-
Northants forge	58/6
,, fdry. No. 3	62/6
,, fdry. No. 1	65/6
Derbyshire forge	62/-
,, fdry. No. 3	66/-
,, fdry. No. 1	69/-
Scotland—	
Foundry No. 1	67/6
,, No. 3	65/-
Hem. M/Nos. d/d	66/-
Sheffield (d/d district)—	
Derby forge	59/6
,, fdry. No. 3	63/6
Lincs forge	59/6
,, fdry. No. 3	63/6
E.C. hematite	74/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	80/-
Clyde, No. 3	80/-
Monkland, No. 3	80/-
Summerlee, No. 3	80/-
Eglinton, No. 3	80/-
Gartsherrie, No. 3	80/-
Shotts, No. 3	80/-

FINISHED IRON AND STEEL.

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	0	0	to	9	15	0
Nut and bolt iron	6	15	0	to	7	10	0
Hoops	10	10	0	to	12	0	0
Marked bars (Staffs) f.o.t.			12	0	0		
Gas strip	10	10	0	to	12	0	0
Bolts and nuts, ¾ in. × 4 in.			13	5	0		
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.					8	5	0
Chequer plts.					10	7	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ⅜ in. (Untested)			6	17	6	& up.	
Flats—8 in. wide and over					8	12	6
,, under 8 in. and over 5 in.					8	17	6
Rails, heavy	8	5	0	to	8	10	0
Fishplates					12	0	0
Hoops (Staffs)	9	10	0	& up.			
Black sheets, 24g. (4-t. lots)			10	5	0		
Galv. cor. shts. (,,)			12	15	0		
Galv. flat shts. (,,)			13	5	0		
Galv. fencing wire, 8g. plain			14	0	0		
Billets, soft	5	5	0	to	5	12	6
Billets, hard	6	12	6	to	7	2	6
Sheet bars	5	0	0	to	5	5	0
Tin bars					5	0	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11d.
Sheet to 10 w.g.	12d.
Wire	12d.
Rods	11d.
Tubes	15½d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7¼
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	18.26
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	13.50
Basic	18.89
Bessemer	19.76
Malleable	19.39
Grey forge	19.39
Ferro-mang. 80%, seaboard	82.00
O.-h. rails, h'y, at mill	40.00
Billets	26.00
Sheet bars	26.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	1.74
Steel bars	1.75
Tank plates	1.70
Beams, etc.	1.70
Skelp, grooved steel	1.60
Steel hoops	1.85
Sheets, black, No. 24	2.25
Sheets, galv., No. 24	2.85
Wire nails	2.10
Plain wire	2.10
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.65

COKE (at ovens).

Welsh foundry	20/- to 25/-
,, furnace	15/-
Durham foundry	21/- to 25/-
,, furnace	15/-
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		16/9 to 17/3
,,	28×20	,,	33/6 to 34/6
,,	20×10	,,	23/10½ to 24/6
,,	18¾×14	,,	17/3 to 17/9
C.W.	20×14	,,	15/- to 15/6
,,	28×20	,,	31/9 to 32/3
,,	20×10	,,	22/6 to 22/9
,,	18¾×14	,,	16/- to 16/6

SWEDISH CHARCOAL IRON & STEEL.

	£	s.	d.		£	s.	d.
Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Oct.	12	33	2	6	dec. 2/6
,,	13	33	6	3	inc. 3/9
,,	16	33	16	3	,, 10/-
,,	17	33	3	9	dec. 12/6
,,	18	33	3	9	No change

Electrolytic Copper.

		£	s.	d.	
Oct.	12	36	0	0	dec. 10 –
,,	13	36	10	0	inc. 10/-
,,	16	37	0	0	,, 10/-
,,	17	36	10	0	dec. 10/-
,,	18	36	10	0	No change

Standard Tin (cash).

		£	s.	d.	
Oct.	12	223	15	0	dec. 2/6
,,	13	223	17	6	inc. 2/6
,,	16	222	15	0	dec. 22/6
,,	17	221	17	6	,, 17/6
,,	18	224	0	0	inc. 42/6

Tin (English ingots).

		£	s.	d.	
Oct.	12	224	10	0	No change
,,	13	224	10	0	,, ,,
,,	16	223	5	0	dec. 25/-
,,	17	222	10	0	,, 15/-
,,	18	224	10	0	inc. 40/-

Spelter (ordinary).

		£	s.	d.	
Oct.	12	16	10	0	No change
,,	13	16	10	0	,, ,,
,,	16	16	11	3	inc. 1/3
,,	17	16	8	9	dec. 2/6
,,	18	16	6	3	,, 2/6

Spelter (Electro, 99.9 per cent.).

		£	s.	d.	
Oct.	12	19	0	0	dec. 2/6
,,	13	18	17	6	,, 2/6
,,	16	19	0	0	inc. 2/6
,,	17	19	0	0	No change
,,	18	19	0	0	,, ,,

Zinc Sheets (English).

		£	s.	d.	
Oct.	12	25	15	0	No change
,,	13	25	15	0	,, ,,
,,	16	25	15	0	,, ,,
,,	17	25	15	0	,, ,,
,,	18	25	15	0	,, ,,

Lead (English).

		£	s.	d.	
Oct.	12	13	5	0	No change
,,	13	13	5	0	,, ,,
,,	16	13	5	0	,, ,,
,,	17	13	5	0	,, ,,
,,	18	13	5	0	,, ,,

Imports and Exports of Iron and Steel Castings, etc., in September and the nine months 1933, compared with September and the nine months 1932

	September, 1932.	September, 1933.	Nine months, 1932.	Nine months, 1933.	September, 1932.	September, 1933.	Nine months, 1932.	Nine months, 1933.
Imports.	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Pipes and Fittings, Cast	278	84	2,235	978	4,653	1,489	39,248	19,538
Castings, in the Rough, Iron	5	20	541	67	131	547	9,756	2,329
,, ,, ,, Steel	90	24	1,379	420	2,075	560	27,276	7,365
Hollow-ware, Cast, not Enamelled	22	8	44	39	1,169	301	2,856	2,235
,, ,, Enamelled	55	28	196	87	1,405	1,097	5,453	4,848
Exports.								
BUILDERS' CASTINGS—								
To Argentine Republic	19	3	281	79	1,055	154	10,445	3,538
,, Irish Free State	95	318	2,707	2,709	4,454	13,024	122,463	113,632
,, British South Africa	73	302	1,092	1,675	2,737	10,625	38,993	67,504
,, ,, India	75	91	629	775	3,170	2,710	22,243	25,812
,, New Zealand	37	12	261	204	2,004	692	13,789	11,547
Total (including other countries)	606	1,288	7,891	8,987	26,662	49,050	330,958	366,587
PIPES AND FITTINGS—CAST—								
To Argentine Republic	4	111	1,307	1,158	72	1,748	14,045	13,405
,, Irish Free State	284	864	5,028	5,030	3,852	12,033	69,834	65,561
,, British South Africa	185	877	2,967	7,152	2,794	8,645	37,487	64,013
,, ,, India	146	127	879	893	1,854	1,518	14,341	13,913
,, ,, Malaya	285	33	1,872	502	2,424	359	19,401	5,091
Total (including other countries)	5,980	6,986	51,009	58,789	51,283	69,846	514,657	563,695
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	174	301	1,763	2,480	5,669	9,160	61,896	77,343
,, Enamelled	47	52	605	546	4,305	4,420	51,038	43,506
CASTINGS, in the rough—								
Iron	55	115	738	790	2,364	3,749	27,964	27,697
Steel	16	74	575	770	984	3,471	24,377	30,330

WILLIAM JACKS & COMPANY,
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ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

BRASS Foundry Foreman seeks engagement; last situation 14 years; considerable experience in Government contracts; phosphor-bronze and manganese castings.—Box 496, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

ENERGETIC Foreman Foundryman (37) requires position; 22 years' experience in modern foundry and patternshop experience; home and abroad. Speaks Spanish. Steel, brass and iron castings. Good organiser and controller.—Box 530, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

SALES Director of well-known iron foundry desires transfer services to foundry producing high-class small and medium iron castings. Can introduce up to 25 tons weekly.—Box 526, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

TO Plumbers' Brassfounders. — Engineer, open to travel, invites inquiry to represent you in Lancashire and Cheshire for chromium-plated taps and fittings.—Address, Box 520, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

REPRESENTATIVES wanted, well-introduced in foundries and steelworks, to sell furnace-patching material on commission.—Box 528, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of The Foundry Trade Journal.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOREMAN Moulder requires position. Has had complete control of foundries doing general engine and air-compressor work; loam, dry-sand and green-sand experience. Light and heavy work. Competent in cupola control. (230)

POSITION required as Foreman or Foundry Manager; considerable experience in light repetition work, including textile, also electrical work and general engineering. Energetic, used to rapid production. (231)

STEEL Foundry Manager or Foreman requires situation. Experience includes converter, open-hearth and electric furnaces, plain carbon and alloy steels. Used to high-class work with well-known firms; locomotive, marine and hydraulic castings. (232)

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AGENCIES required by Technical Man, well known iron, steel, foundry trades in London, Midlands and South Wales. Only first-class propositions considered.—Box 532, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

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AGENT wanted in Lancashire for Sale of High-grade Foundry Pig-iron.—Apply to "Blast Furnaces," c/o Box 524, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY.

MAGNIFICENT

11 ACRES WORKS SITE.

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WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

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ALBION WORKS, SHEFFIELD.

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By Order of James Douglas, Esq., C.A., Receiver for the Debenture Holders.

Re Derby Castings, Limited.

DERBY.

HENRY BUTCHER & COMPANY will offer for Sale by Auction on the Premises (unless previously sold), on Wednesday, November 1, 1933, at 11 a.m., the Extensive

FREEHOLD MANUFACTURING PREMISES

known as the "BRITANNIA IRON WORKS," with frontages to Duke Street and River Street, close to centre of town, with Sidings to L.N.E.R., having a

FLOOR SPACE OF 76,000 SQ. FT.,

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FOUNDRY PLANT AND EQUIPMENT,

including "JACKMAN" and "TITAN" CUPOLAS up to 3 Tons per hr.: SQUEEZING MACHINES: SAND MIXERS: JARRING MACHINES: MOULDING MACHINES: ROLLER PAN MILLS up to 6 ft. 6 in.: SAND-BLASTING PLANTS: ELECTRIC OVERHEAD TRAVELLING CRANES, 230 and 460 VOLTS, up to 5 TONS: Jib Cranes: Foundry Ladles: Tip Wagons: Trucks: Sand Dryers: Rumblers: "Mansfield" and other Sand: 200 Tons assorted FOUNDRY BOXES: 12 TONS PIG-IRON: 40 TONS FLOOR PLATES: VERTICAL and HORIZONTAL AIR COMPRESSORS: ELECTRIC MOTORS, 400 Volts, 3-phase, up to 50 h.p.: 3-ft. 6-in. "AMERICAN" RADIAL DRILL: S.S. and S.C. GAP BED LATHES: "Denbigh" Milling Machine: Drilling Machines: Band and Circular Saws: Platform Weighing Machines: 5-TON "DENNISON" WEIGHER: 20-TON RAIL WEIGHBRIDGE by Pooley: Quantity of Stores, etc., together with the CONTENTS OF LABORATORY, OFFICE FURNITURE and Other Effects.

Particulars and Catalogues of Messrs. J. & J. Sawyer & Company, Chartered Accountants, 31, Budge Row, Cannon Street, E.C.4; of Harold Shephard, Esq., Solicitor, 25, Dover Street, London, W.1, or of Messrs. Henry Butcher & Company, Plant and Machinery Auctioneers, 63 and 64, Chancery Lane, London, W.C.2.

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THOS. W. WARD, LTD.

12½" cens. S.S.S. All-geared Head LATHE, 20' gap bed.

Hori. HYDRAULIC SURFACE GRINDER, working surface of table 24" x 7".

No. 7 "Empire" PRESSURE BLOWER, cap. 180 cub. ft. per min.

10-n.h.p. Semi-Port. LOCO. BOILER, barrel 6' x 2' 9" dia.; 140 lbs. w.p.

6 Self-supporting MILD-STEEL CHIMNEYS, 150' high x 6' 6" dia.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD

MACHINERY—*Continued.*

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Room, Rotary Barrel and Cabinet Types complete; 12 in stock.

SAND PLANT

Sand Mills, 6-ft., 5-ft. and 4-ft. 6-in. dia. Pans.

Rotoil "Senior" Oil Core Sand Mixer.

Pneulec Sand Drying Plant, output 1 ton per hour.

Brearley Type Disintegrators.

MOULDING MACHINES

Hand and Pneumatic Types.

Also

Six Rowlands Double-ended Grinders for 24-in. dia. x 2-in. wheels.

Electrical and Belt-driven Blowers and Exhaust Fans, Ladles, etc., etc.

AIR COMPRESSORS

Say all sizes for high and low pressures.

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CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.

'Phone: Broadwell 1359.

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Two "Tabor" 18"×36" portable rollover jolters £60 each.

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30"×20" Macdonald rollover jolter £60

20"×16" Macdonald rollover jolter £40

8 Ton Macdonald plain jolter, 20" cylinder .. £160

SAND PLANT

NEW 5 foot self-discharging sandmill £40

Herbert "Whizzer" type disintegrator, No. 1 £30

Herbert "Whizzer" type disintegrator, No. 2 £46

Rotary sand mixer and elevator £24

Gyratory sand riddle with motor £7

Large "Baillott" sand preparing plant CHEAP.

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*

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added to your floor sand provides the ideal re-bonding medium.

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